A Prospective Study on

FUNCTIONAL AND RADIOLOGICAL OUTCOME OF PERTROCHANTERIC FRACTURE IN ELDERLY PATIENTS TREATED WITH DYNAMIC HIP SCREW OR PROXIMAL FEMORAL NAIL

Dissertation submitted to

THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

Chennai

In partial fulfilment of the
regulations for the award of the
degree of

MS (ORTHOPAEDIC SURGERY)

BRANCH – II

KILPAUK MEDICAL COLLEGE CHENNAI-600010

APRIL – 2014

CERTIFICATE

This is to certify that **Dr.RAMESH.B**, post-graduate student (2012-2014) in the Department of Orthopaedic Surgery, Kilpauk Medical College, has done dissertation on **"FUNCTIONAL AND RADIOLOGICAL OUTCOME OF PERTROCHANTERIC FRACTURE IN ELDERLY PATIENTS TREATED WITH DYNAMIC HIP SCREW OR PROXIMAL FEMORAL NAIL "**under my guidance and supervision in partial fulfilment of the regulation laid down by the 'THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY, CHENNAI -32'for M.S.Orthopaedic Surgery degree examination to be held in April2014.

Prof .S.ANBAZHAGAN
M.S. Ortho,D.ortho,DNB Ortho.,
Professor of Orthopaedics,
Government Royapettah Hospital,
Chennai -14.

Prof.N.NAZEER AHMED, M.S.Ortho,D.Ortho,
Professor and Head of the Department,
Department of Orthopaedics,
Kilpauk Medical College,
Chennai – 10.

Prof. P. RAMAKRISHNAN, M.D, D.L.O,

Dean,

Kilpauk Medical College,

Kilpauk, Chennai – 10.

DECLARATION

I, **Dr.RAMESH.B**, solemnly, declare that this dissertation titled **''FUNCTIONAL AND RADIOLOGICAL OUTCOME OF PERTROCHANTERIC FRACTURE IN ELDERLY PATIENTS TREATED WITH DYNAMIC HIP SCREW OR PROXIMAL FEMORAL NAIL "** is a Bonafide work done by me at Government Royapettah Hospital , Kilpauk Medical College, during the period from 2012 to 2014, under the guidance and supervision of my Unit Chief **Prof. S.ANBAZHAGAN ,** M.S.(Ortho),D.Ortho,DNB.Ortho. This dissertation is submitted to "THE TAMILNADU DR MGR MEDICAL UNIVERSITY", towards partial fulfilment of regulations for the award of M.S.DEGREE BRANCH II in Orthopaedic Surgery.

Place: Chennai

Date : **DR.RAMESH.B**

ACKNOWLEDGEMENT

I express my utmost gratitude to **Prof. P. RAMAKRISHNAN** M.D, D.L.O, Dean, Kilpauk Medical College, Chennai, for providing me an opportunity to conduct this study and for permitting me to use the hospital facilities for my study to the full extent.

I would like to express my sincere thanks and gratitude to my beloved Chief,**Prof.S.ANBAZHAGAN,**M.S.Ortho,D.Ortho,DNB.,Ortho Professor of Orthopaedics, Government Royapettah Hospital , Kilpauk Medical College, Chennai -10, who kindly accepted to be my guide for the study and offered valuable suggestions to make this study a successful one.

I would like to express my gratitude and reverence to my beloved Head of Department, **Prof.N.NAZEER AHMED**,M.S.(Ortho),D.Ortho, whose guidance and help has elevated me to this level, to conduct this study successfully. I sincerely thank him for the expert guidance and constant encouragement to conduct this study.

I wish to express my sincere gratitude and heartfelt thanks to **Prof.N.O.SAMSON** M.S.(Ortho), D.Ortho. who allotted me this topic whose efforts has elevated me to this level and

Prof.R.BALACHANDRAN, M.S.(Ortho), D.Ortho **,Prof.K.RAJU** M.S.(Ortho), D.Ortho for their encouragement and guidance .

I am deeply indebted to my beloved Assistant Professors

Dr.V.THIRUNARAYANAN M.S.Ortho.,

Dr.D.R.RAMPRASATH M.S.Ortho.,D.Ortho .,

Dr.M.ARUNMOZHIRAJAN M.S.(Ortho),

Dr.B.THANIGAIARASU M.S.Ortho.,

not only for guiding me in every aspect of this study but for the whole of my postgraduate career as well through their valuable advice and guidance.

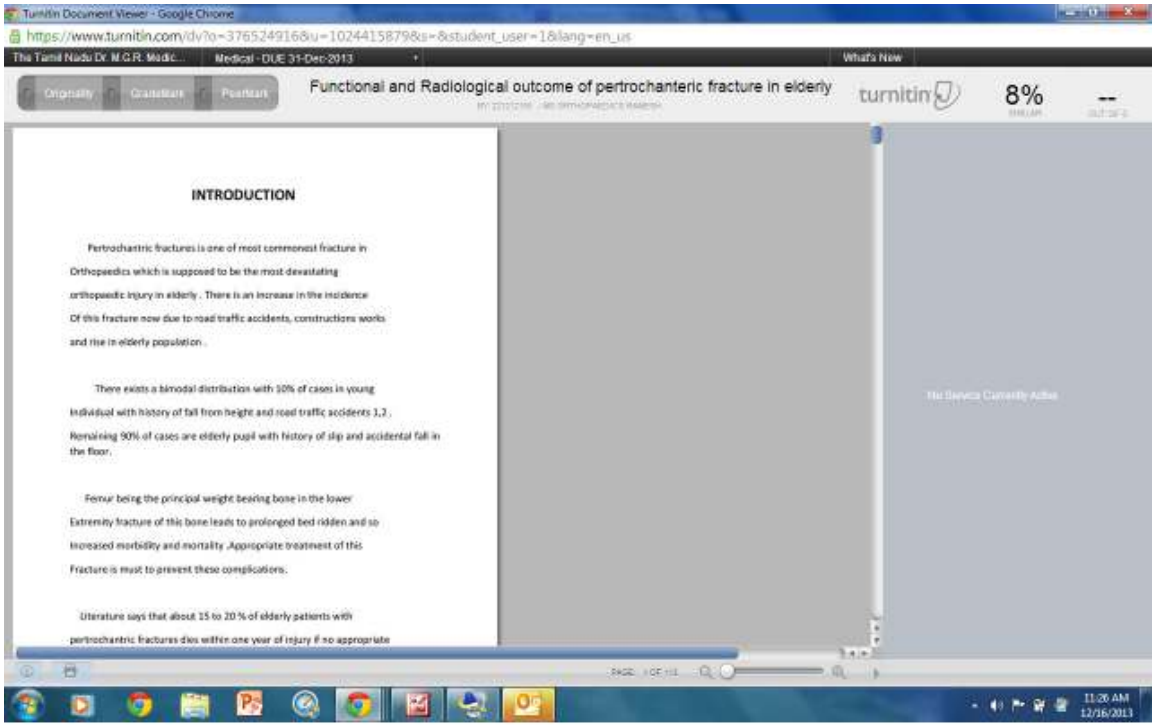
I wish to express my thanks to my beloved assistant professors **Dr.P.KOSALARAMAN ,**M.S.Ortho,.**Dr.A.SARAVANAN ,**M.S.Ortho,

Dr.A.SRINIVASAN M.S.Ortho , **Dr.F.FAKHURUDIN** M.S.Ortho., for the valuable advice and guidance.

I wish to express my thanks to anaesthesiologists, postgraduate

Colleagues, staff members, and theatre staff for the help they have rendered.

I thank all my patients who gave full cooperation for this study without whom this study wouldn't been possible.


Turnitin Document Viewer - Google Chrome
https://www.turnitin.com/dv?o=376524916&u=1024415879&s=&student_user=1&lang=en_us
The Tamil Nadu Dr. M.G.R. Medic...
Medical - DUE 31-Dec-2013
What's New
Originality
Grademark
Peermark
Functional and Radiological outcome of pertrochanteric fracture in elderly
turnitin
8%
--
INTRODUCTION
Pertrochantric fractures is one of most commonest fracture in Orthopaedics which is supposed to be the most devastating orthopaedic injury in elderly . There is an increase in the incidence Of this fracture now due to road traffic accidents, constructions works and rise in elderly population .
There exists a bimodal distribution with 10% of cases in young individual with history of fall from height and road traffic accidents 1,2 . Remaining 90% of cases are elderly pupil with history of slip and accidental fall in the floor.
Femur being the principal weight bearing bone in the lower Extremity fracture of this bone leads to prolonged bed ridden and so increased morbidity and mortality .Appropriate treatment of this Fracture is must to prevent these complications.
Literature says that about 15 to 20 % of elderly patients with pertrochantric fractures dies within one year of injury if no appropriate
No Device Currently Active
11:26 AM
12/16/2013

CONTENTS

FUNCTIONAL AND RADIOLOGICAL OUTCOME OF PERTROCHANTERIC FRACTURE IN ELDERLY PATIENTS TREATED WITH DYNAMIC HIP SCREW OR PROXIMAL FEMORAL NAIL.

Introduction .

Pertrochanteric fractures is one of the most commonest fracture in orthopaedics .There is an increase in the incidence of this fracture now due to road traffic accidents ,constructions works and rise in elderly population. Appropriate treatment early mobilization of patients are must to prevent morbidity and mortality due to fracture disease. Pertrochantric fractures were treated in the past with prolonged traction and then mobilization which leads to shortening and deformity of limb along with morbidity and mortality due to prolonged traction .Then comes the operative treatment of this fracture using fixed angle devices with the drawback of more complications .Dynamic hip screw with advantage of controlled impaction with less complications were introduced which is the implant of choice in stable pertrochanteric fracture .The complications with dynamic hip screw in unstable pertrochanteric fracture was more than stable fracture .Intramedullary devices were introduced with the aim of minimizing the complications in unstable fracture fixation.

Aim.

The aim of the study was to assess the functional and radiological outcome of pertrochanteric fracture in elderly patients treated with dynamic hip screw or proximal femoral nail.

Material and methods.

The study was conducted in Government Royapettah hospital ,from May 2012 to December 2013 .20 cases of pertrochantric fractures admitting in casualty was evaluated for inclusion criteria .Patients with age over 55 years were include in our study and patients with pathological fracture were excluded .The 20 patients were divided into stable and unstable groups using Evans classification. DHS was done for 10 of them and PFN for another 10 of them and results were evaluated.

Observation and results.

Most of the patients in our age group were between 55 to 65 years around 80% .Males predominate in our study by 70% left sided fracture more in our study .The mean duration of surgery ,mean blood loss and mean length of incision was more in DHS group then PFN group. We came across more intraoperative complications in PFN group then DHS group. Time of weight bearing was more in unstable fracture in DHS group. The Harris hip score was in favor of PFN at six weeks after surgery but it became same in both groups after 20 weeks of surgery.

Discussion.

Intertrochanteric fracture is a challenge to orthopaedic community besides achieving union the need here is the restoration of optimal function in shortest period with minimal complications. This can be achieved by stable fixation with correct implant.

Conclusion .

PFN has advantage of smaller incision, less blood loss and less morbidity. The short lever arm and lower bending moment in PFN may add mechanical advantage to the construct which makes it the implant of choice in osteoporotic bones .Deformity and complications was less in PFN group in our study .Rate of fracture

union was similar in both groups with early mobilization in PFN group ,DHS found to be the implant of choice as for as stable fracture is concerned but for unstable fracture the pendulum swings in favor of PFN .

Key words .

Pertrochanteric fracture ,DHS ,PFN ,Harris hip score.

INTRODUCTION

Pertrochantric fractures is one of most commonest fracture in orthopaedics which is supposed to be the most devastating orthopaedic injury in elderly [1,2,3]. There is an increase in the incidence of this fracture now due to road traffic accidents, constructions works and rise in elderly population .There exists a bimodal distribution with 10% of cases in young individual with history of fall from height and road traffic accidents [1,2] .Remaining 90% of cases are elderly people with history of slip and accidental fall in the floor .

Femur being the principal weight bearing bone in the lower extremity. Fracture of this bone leads the patient to be bed ridden for prolonged period and so increased morbidity and mortality .Appropriate treatment of this fracture is must to prevent these complications [2,3].

Literature says that about 15 to 20 % of elderly patients with pertrochantric fractures dies within one year of injury if no appropriate treatment is given[4] . Previously these fracture are treated conservatively with traction and prolonged bed rest for 10 to 12 weeks followed by ambulation training. Prolonged bed rest leads to increase in morbidities like bed sores urinary tract infections, respiratory tract infections, joint stiffness.

To avoid these complications operative treatment of these fractures are tried with the aim of early bed to chair mobilization of these patient.[5]The better understanding of fracture geometry and biomechanics leads to the development of a lot of implants for treating these fractures. The first one in the history is Jewett and Holt nail which is a fixed angle nail plate .These nail plate failed because of lack of controlled impaction.

The sliding hip screw has been used for fixation of these fractures. High failures were noted in those fractures with loss of posteromedial congruity.[6]To overcome this, intramedullary devices were developed with theoretical advantage of more load transfer, with short lever arm and decreased implant failure rate.

The goal of treatment in pertrochanteric fracture is early mobilization of patients to prevent morbidity and mortality and the early mobilization depends on the stability of surgical construct [7].

With these goals of better stable surgical construct of pertrochanteric fractures and early mobilization of patients ,this study was conducted to compare the functional and radiological outcome of pertrochanteric fractures in elderly patients treated with dynamic hip screw and proximal femoral nail.

AIM OF THE STUDY

To assess the functional and radiological outcome of pertrochanteric fracture in elderly patient treated with dynamic hip screw or proximal femoral nail.

ANATOMY

The femoral head, neck of femur, the greater trochanter, the lesser trochanter and the area between greater and lesser trochanter all forms the proximal femur .The pertrochanteric region serves as zone of transition from femoral neck to femoral shaft[9].

THE FEMORAL HEAD.

Femoral head forms a two third of a sphere and is connected to the shaft of femur through neck. The round head of femur articulates with cup like acetabulum of hip bone .The neck of femur is directed upwards medially and slightly anteriorly so that the head articulate with the acetabulum .The head of femur is covered with articular cartilage and has a pit in the medial aspect called '' Fovea'' where the ligamentum teres is attached .

NECK OF FEMUR

The neck connects the femoral head to the femoral shaft. It's trapezoidal with its narrow end supporting the head and its broader base being continuous with the shaft. The proximal femur is bent so that the head and neck projects superomedially at an angle to that of oblique oriented shaft .This obtuse angle of

inclination is greatest at birth and gradually diminishes until adult age is reached [115-140*] averaging 126*[8,9].

This angle of inclination allows greater mobility of the femur at the hip joint because it places the head and neck more perpendicular to the acetabulum In neutral position .The abductors and rotators of the thigh attach mainly to the apex of angle greater trochanter so they are pulling on a lever that is directed more laterally than vertically.

The angle of inclination imposes considerable strain on the neck of femur. when the femur is viewed from above .it is apparent that the long axis of head and neck lie at angle 10 to 15 * with the transverse axis of inferior end femoral condyles [10].This angle of declination combined with angle of inclination allows rotatory movements of hip

GREATER TROCHANTER

Its large laterally placed bony mass that projects superiorly and posteriorly where the neck joins the femoral shaft, providing attachment and leverage for abductors and rotators of the thigh.

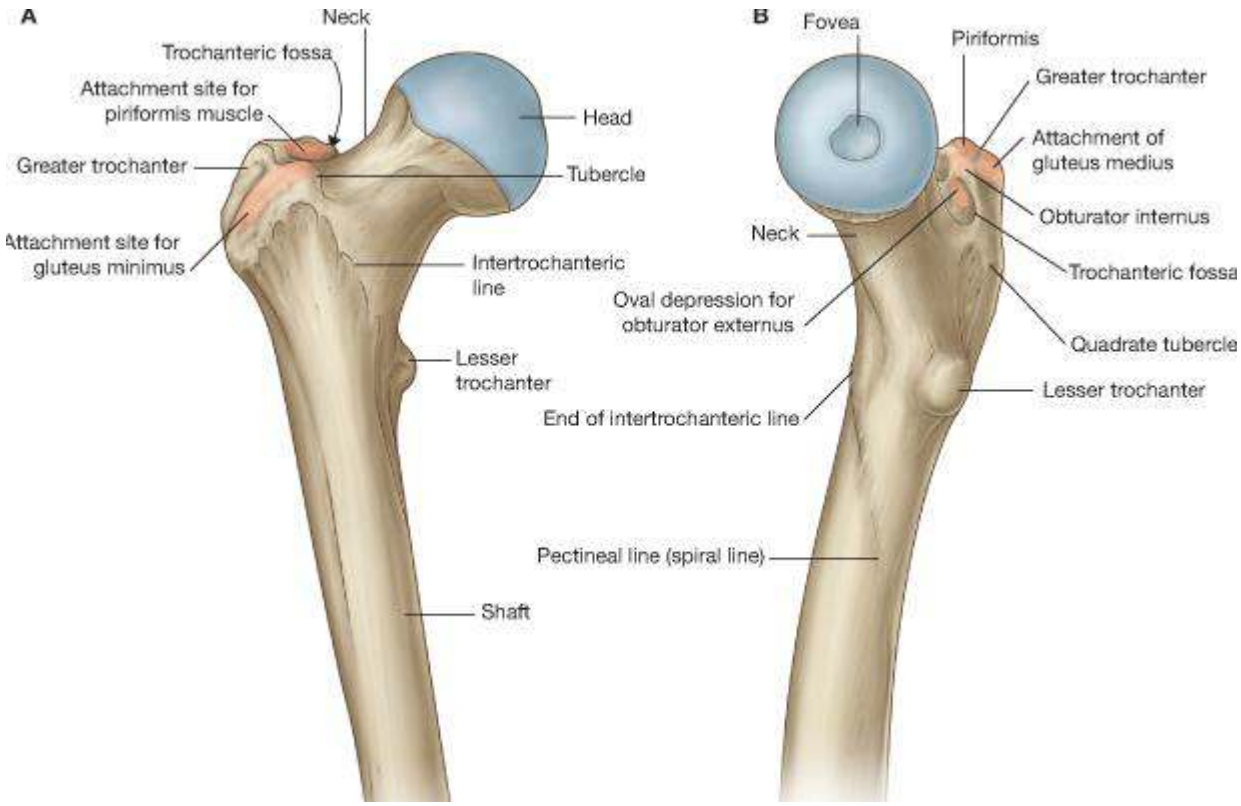


Figure 1. Anatomy of proximal femur anterior and posterior view

It has two surfaces medial and lateral and four borders [superior, inferoanterior and posterior.]

Lateral surface : Serves for the insertion of the tendon of gluteus medius. The medial surface: The trochanteric fossa for the insertion of the tendon of obturator externus and the insertion of the obturator externus and gemelli.

The superior border: Insertion of pyriformis

The inferior border : Gives origin to the upper part of the vastus lateralis.

The anterior border: At its lateral part insertion to the gluteus minimus

The posterior border: bounds the back part of trochanteric fossa.

The site where the neck and shaft join is indicated by the intertrochanteric line , a roughened ridge by the attachment of a powerfull iliofemoral ligament. The intertrochanteric line runs from the greater trochanter and winds around the lesser trochanter to continue posteriorly and inferiorly as a less distinct ridge the spiral line.

A similar but smoother and more prominent ridge the intertrochanteric crest joins the trochanters posteriorly. The rounded elevation on the crest is the quadrate tubercle.

LESSER TROCHANTER

This is the blunt elevation over the medial aspect where the neck joins the femoral shaft. Lesser trochanter is abrupt , conical and rounded projections gives attachment to the primary flexor of thigh, iliopsoas .

In accordance to Wolff's Law, trabecular bone is formed along the lines of weight transmission in the proximal femur into many groups. These trabecular

groups considerably increases the strength of proximal femur. It consists of five trabecular groups [10, 11]. They are

a. Principal compressive group:

It is the upward projection of the calcar femorale to the weight bearing superior dome of the head of femur

b. Principal tensile group:

It is also called the Arcuate bundle of Gallois and Bosquette. It starts in the inferior region of head, arches across the superior region and terminates in the lateral cortex.

c. Greater trochanteric group:

Seen in the region of greater trochanter

d. Secondary compressive group:

This group extends from the greater trochanter to the lesser trochanter. This third group corresponds to secondary compressive forces

e. Secondary tensile group:

This extends from the secondary compressive group to the lateral

Shaft; this group corresponds to secondary tensile forces.

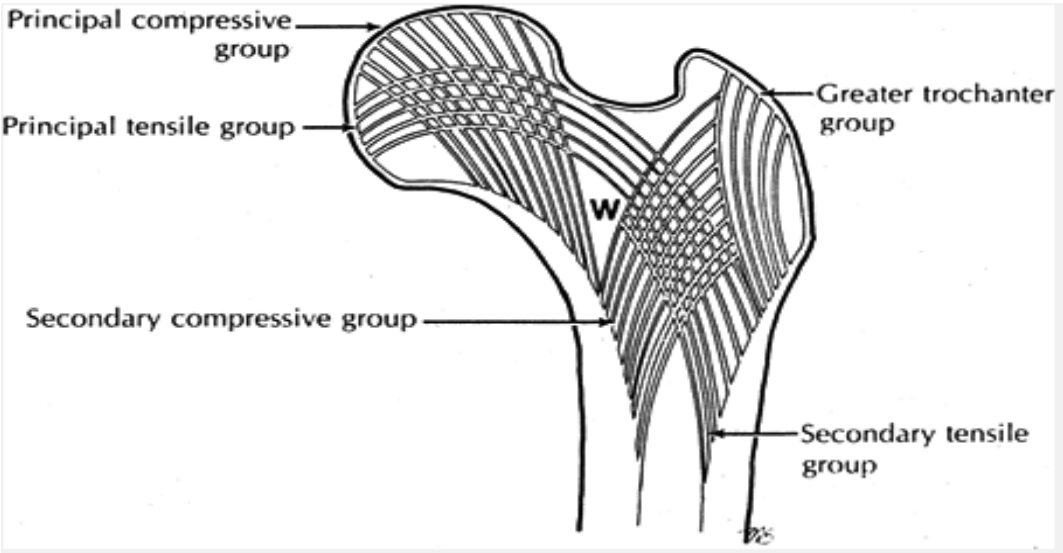


FIG.2 Trabecular pattern in proximal femur

The primary compression and primary tensile trabeculae enable the proximal femur to withstand considerable tensile and compressive forces to which it is normally subjected. In the greater trochanter, a Gothic arch is formed by the intersection of arcuate bundle and trochanteric bundle [12,13]. The head and neck also contain a Gothic arch formed by the intersection of arcuate bundle and

Supporting bundle. At the point of intersection, the bone is denser and constitutes the nucleus of the head (6).

There are two areas where trabeculae are deficient, the Babcock triangle situated in the inferior aspect of the head, and the Ward's triangle situated lateral

to primary compression trabeculae and below tension trabeculae in the middle part of the neck. They play a prominent role in the causation of femoral neck fractures in the elderly. They offer less rigid fixation to any implant in this area. They also offer little resistance to shearing forces in fracture neck of femur even after fixation of the fracture.

CALCAR FEMORALE

It is a dense vertical plate of bone extending from the posteromedial portion of the femoral shaft under the lesser trochanter and radiating later to the greater trochanter reinforcing the femoral neck posteroinferiorly. It is thickest medially and gradually thins as it passes laterally. In literature regarding hip arthroplasty, medial cortex of femoral neck has frequently been mistakenly labeled as the calcar.

VASCULAR ANATOMY OF PROXIMAL FEMUR

Crock divided the arterial supply of proximal femur into three major groups: They are:

a. An extracapsular arterial ring located at the base of the femoral neck.

b. Ascending cervical branches of the extracapsular arterial ring on the surface of the femoral neck.

c. The arteries of the round ligament.

The extracapsular arterial ring and the ascending retinacular vessels are derived from the medial and lateral circumflex femoral arteries. The medial circumflex artery, usually a branch of the femoral artery courses posteriorly between the iliopsoas and pectineus muscles and then between the medial capsule and obturator extenus muscle before passing along the posterior intertrochanteric line. It gives a small branch called inferior retinacular (medial ascending) artery. It gives branches to the femoral neck and then passes over the epiphysial growth plate to enter the capital femoral epiphysis in children. Posteriorly, the medial circumflex femoral artery communicates with branches of superior gluteal artery and gives off small Posterior retinacular arteries.

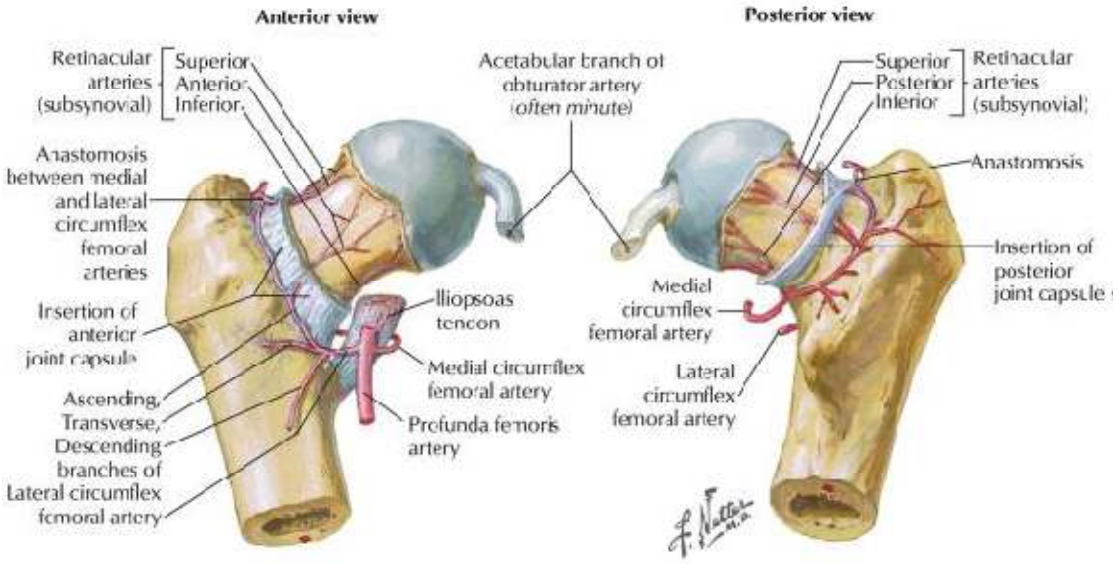


Figure 3 .Blood supply of femoral head

The termination of medial circumflex femoral artery becomes the Superior retinacular (lateral ascending) artery, which supplies the greatest portion of blood to the head of femur in adults and the capital femoral epiphysis in children. This artery penetrates the capsule in the trochanteric notch (an extremely narrow space between the greater trochanter and femoral neck) and is therefore vulnerable to injury in fractures of neck of femur**.**

The lateral circumflex femoral artery usually arises from the profunda femoris artery. It passes lateral and anterior to the iliopsoas muscle, giving off the anterior retinacular (anterior ascending) branch to the proximal femur. The

lateral circumflex femoral artery communicates with the medial circumflex femoral artery in the trochanteric fossa, completing the extracapsular arterial ring. The anterior portion of this ring is thus derived primarily from the lateral circumflex femoral artery, whereas the medial, posterior and lateral portions are derived from the medial circumflex femoral artery.

The branches of the ascending retinacular arteries form a subsynovial anastamotic intrarticular arterial ring at the margin of the articular cartilage of femoral head. The artery of the ligamentum teres contributes only a small portion of the arterial blood supply to the center of the femoral head. It is a branch of the obturator or the medial circumflex femoral artery.

Femoral head circulation arises therefore from 3 sources: Intraosseous cervical vessels that cross the marrow space from below, the artery of ligamentum teres and chiefly the retinacular vessels which are branches of the extraarticular arterial ring. When a fracture of femoral neck occurs, the intraosseous cervical vessels are disrupted; femoral head nutrition is then dependent on the retinacular vessels and the artery of ligamentum teres.

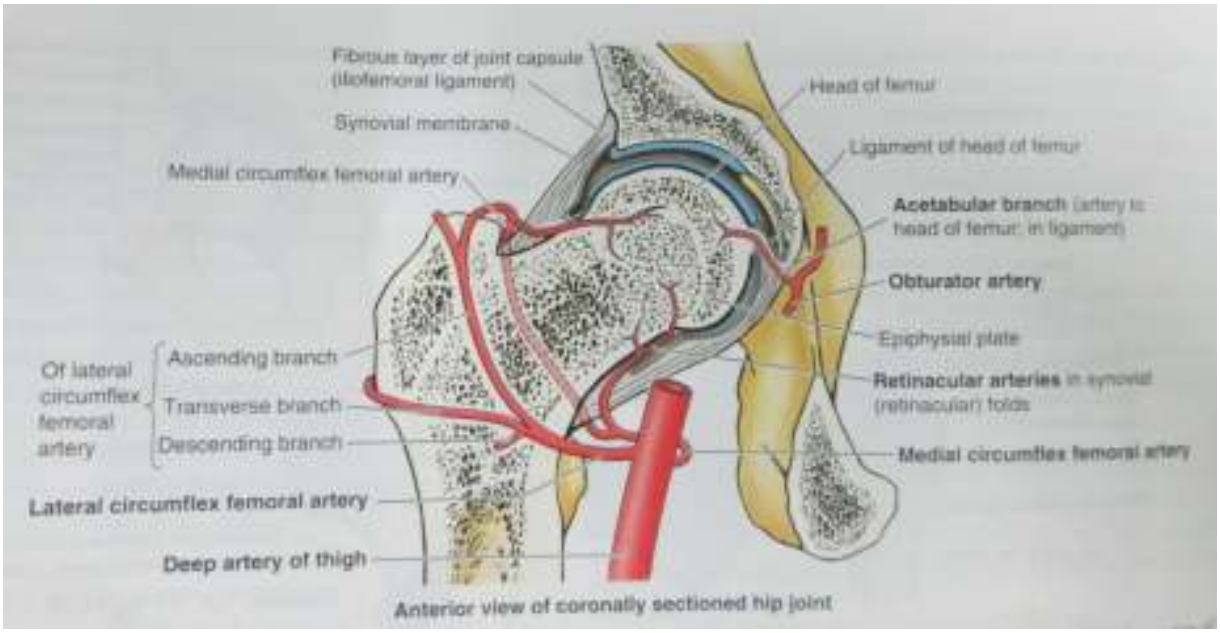


Fig 4 .Blood supply of femoral head

ANATOMY OF SOFT TISSUES AROUND HIP

Fascia lata is the first structure that is seen after skin incision in the lateral aspect. Fascia lata gets its muscular inputs from the gluteus medius and tensor fascia lata. Fascia lata is the flexor and abductor of the hip joint. It is supplied by superior gluteal nerve coming out from underneath the gluteus medius.

Extensors:

The extensors of the hip are the gluteus maximus which is the strongest muscle of body. It has its origin from the posterior third of iliac crest and from the sacrum and coccyx, its runs anteriorly and inferiorly from its origin and

insert into the fascia lata and posterolateral margin of the femur just below lesser trochanter. The gluteus maximus is supplied by inferior gluteal nerve.

Abductors:

Gluteus medius and gluteus minimus are the abductors of the hip joint which originates from the entire wing of ilium and insert into the lateral aspect of greater trochanter. The gluteus medius and gluteus minimus is innervated by branches from superior gluteal nerve.

External rotators:

External rotators of hip are pyriformis, obturator internus, obturator externus, gemelli and quadrates femoris. Pyriformis muscle orginate from the lateral margin of anterior surface of sacrum and greater sciatic foramen , comes out from the foramen and insert into tip of greater trochanter. Often it is blended at its insertion with common tendon of obturator internus and gemelli. The sciatic nerve lies below the pyriformis muscle.

The obturator internus arise from inside the obturator foramen passes out the pelvis through lesser sciatic foramen and inserted into tip of trochanter. It is innervated by nerve from sacral plexus.

The obturator externus has its origin from medial side of the obturator foramen.Its fibres run across back of neck of femur and insert into the trochanteric fossa. Obturator nerve innervate this muscle.

Quadratus femoris arises from the upper part of illium and inserts into the upper part of linea quadrata in the intertrochantric crest. It is innervated by a branch from sacral plexus. The applied anatomy is that the quadrates femoris marks the inferior margin of muscle release in the exposure of hip through posterior approach .sciatic nerve lies superficial to these groups of extensor muscle.

Flexors:

Psoas muscle is the prime flexor of hip joint .It has its origin from lumbar vertebra and insert into the tip of lesser trochanter. Its broad lateral part is called as illiacus which arise from iliac fossa and insert below lesser trochanter. The other flexors of hip are Sartorius pectineus and gracilis muscle.

Adductors:

The muscle of medial compartment of thigh comprise the adductor group consisting of adductor longus, adductor brevis, adductor magnus, gracilis These muscles orginate from pubic bone ischiopubic ramus and ischial tuberosity and the obturator membrane and inserts into the linea aspera of femur and adductor

tubercle of femur .All adductors are supplied by obturater nerve and adductor magnus has dual nerve supply.

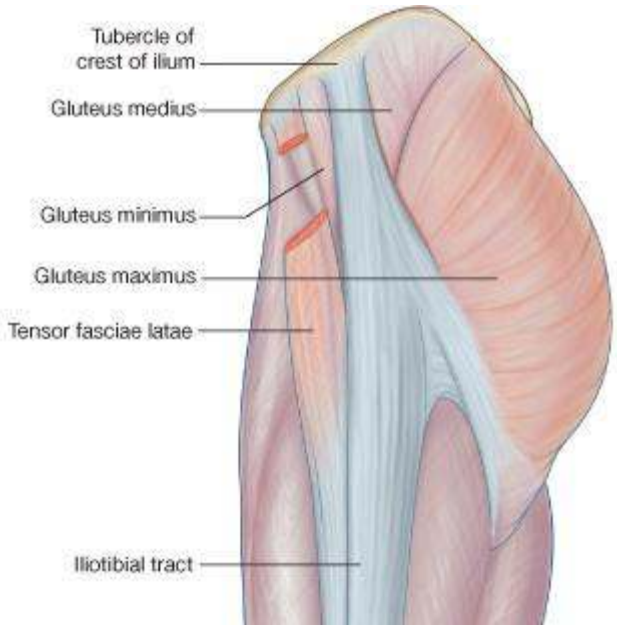


Fig 5.Lateral aspect of thigh

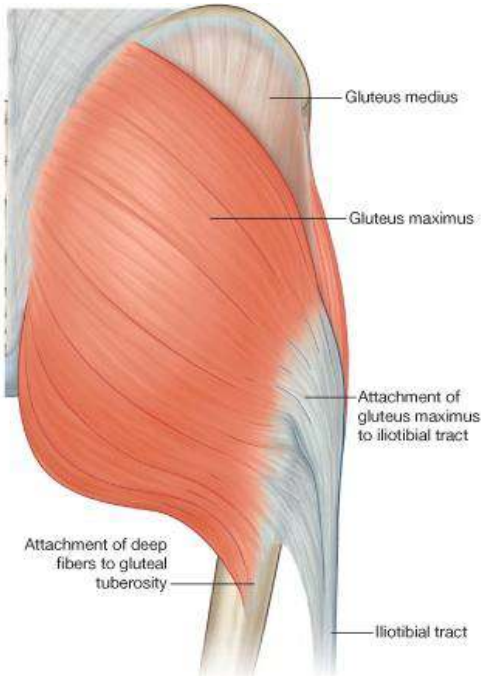


Fig 6 . Posterior aspect of thigh

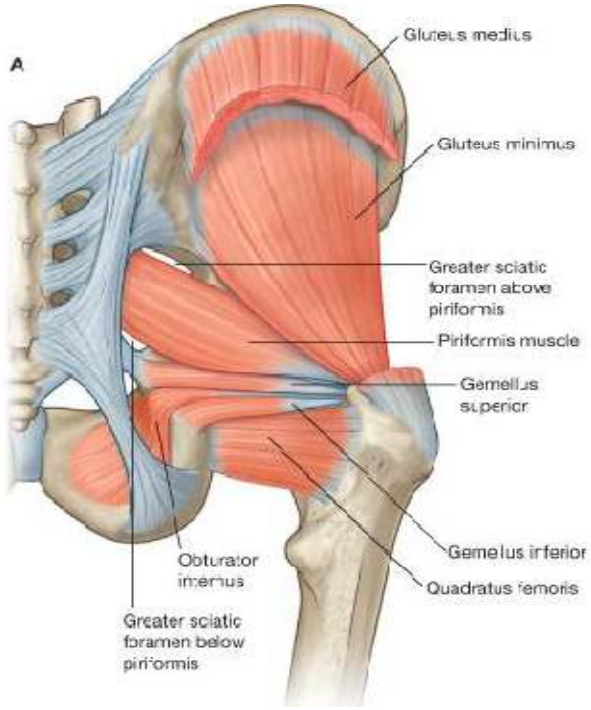


Fig 7.Posterior aspect of thigh

BIOMECHANICS OF HIP JOINT

Hip joint is ball and socket joint. In weight bearing the pressure forces are transmitted to the head and neck of the femur at an angle of 165 degrees to 170 degrees regardless of position of pelvis. This pressure force coincides with the well-formed trabeculae along the posteromedial aspect of femoral neck so called calcar which extends along superomedial aspect of femoral head .These pressure trabeculae are in line pressure trabeculae that starts at acetabulum and run upwards and medial to sacro-iliac joint .

The unique anatomy of intertrochanteric region helps to match its variable function. Our day today activities load the hip joint with bending, torsional and axial loads .The greater trochanter with large dimension greater peripheral substance and large cortical surface helps to overcome these stresses. Tensions created by muscle groups attached at trochanteric region also give stress to this region .The protrusion of greater trochanter acts as lever arm for the attached muscles. The trabecular bone pattern in this intertrochanteric area resists this combination of forces acting on the hip.

Forces acting on the hip are

1. Compressive forces generated by gluteus medius
2. Body weight
3. Joint Reaction force
4. Bending stress
5. Shear stress
6. Torque transmitted by the shaft

The neck of femur act like a offset from shaft –which is the main cause of bending forces.

The abductor muscle force and the hip joint reaction force produce large stress on the femoral head and neck[16]. The gluteus medius create axial compressive force along femoral neck which may be equal to three times the

body weight .The axial compressive force due to muscles and the weight of body together generate forces that act on the hip joint. Hip joint reaction force which is equal to the axial compressive muscle force is developed which acts in opposite direction. The hip joint function as a fulcrum. For the equilibrium of this fulcrum the joint reaction force must be equal to the sum of abductor force and body weight force.

In intertrochanteric fractures compressive and bending load act on the fracture. The intact lateral part of trochanter makes the compression effective since the distance between the line of action of joint and fracture is more in intertrochanteric fracture ,the bending load is high here which may reach a maximum of 4000 N.

The intact abductor force in undisplaced intertrochanteric fracture contributes to the stability of reduced fracture.

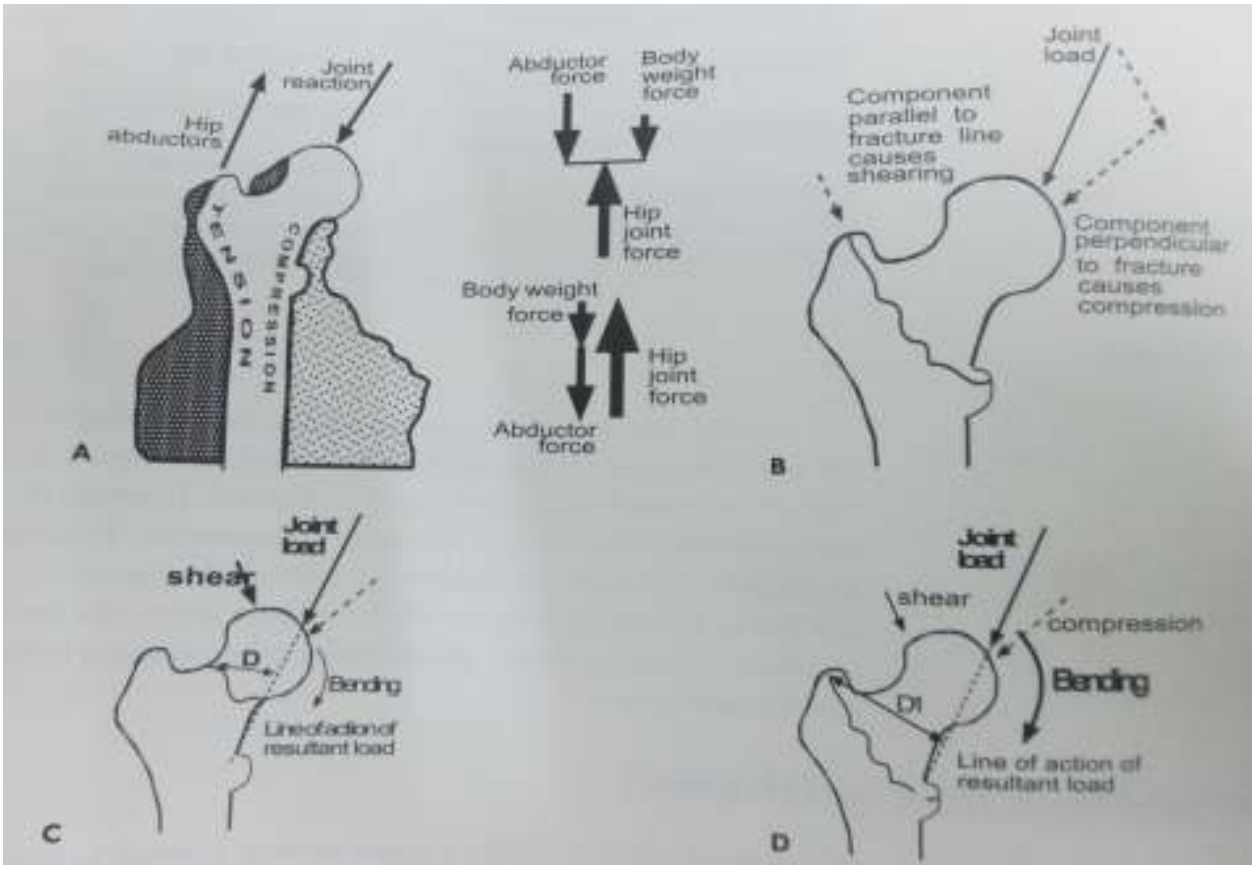


Fig 8.Forces acting on hip joint.

BIOMECHANICAL CONTRIBUTION OF MUSCLES

The forces acting along the proximal and distal segments of fracture produce peculiar deformity.The proximal fragment is flexed by illiopsoas , abducted by gluteus medius and gluteus minimus , and externally rotated by short external rotators.

The distal fragment is adducted by the action of powerful adductors .Overall action of long muscle cause shortening and overriding of fracture fragments.

Fig 9 and 10 .Forces acting in subtrochanteric fracture

FACTORS AFFECTING FRACTURE FIXATION

Loads generated at trochanteric fracture site act in two directions – Parallel &perpendicular to fracture line. These two different directional forces conjointly act on fracture producing shear & compression stresses across fracture site.

Shear force act parallel to fracture line & tends to displace the femoral head downwards relative to femoral shaft. Compression force act in perpendicular direction & tends to compress the femoral head against femoral neck. Compression force brings fracture fragments together causing mechanical interlocking of fracture fragments. Bending stress in intertrochanteric fractures high which produces varus displacement of proximal fragment.

The pull out strength of a hip screw is proportional to the bone density In the femoral head. Centre of head has densest bone density and the screw should be located here. The stability of fracture fixation depends on the degree of commination. More resistance is offered to the deforming forces if the degree of communition is less. The magnitude of bending and shear loads are determined by the length of femoral neck and neck shaft angle. The load acting at the fracture site is more if the neck length and neck shaft angle are more ,the fixation fails here.The load acting at the fracture side is directly proportional to neck shaft angle , surgical construct stability depends on neck shaft angle.

PATHOMECHANICS OF FRACTURE

In intertrochanteric fracture above the insertion of external rotators the proximal fragment is internally rotated .so for reduction of fracture internal rotation of distal fragment is to be done .In case of intertrochanteric fracture with

subtrochanteric extension external rotation of proximal fragment occurs and this type of fracture is reduced by external rotation of distal fragment.

ANGULATION AT FRACTURE SITE.

Varus angulation of proximal fragment occurs in intertrochanteric Fracture due to muscle pull of hamstring and gastronimus.Varus angulation produce marked widening of fracture line.

FRACTURE GEOMETRY

Intertrochanteric fracture of unstable type may have four fragments.

1. Proximal neck
2. Greater trochanter
3 .Lesser trochanter
4. Proximal femoral shaft

In unstable fracture with posteromedial and posterior incongruity collapse of fracture with implant failure occurs. The lateral wall of greater trochanter is fragile and its fracture converts intertrochanteric fracture into subtrochanteric fracture .Intactness of lateral wall is must for controlled compression of proximal fragment which prevents the rotational, varus collapse of fracture during fracture

impaction .The load over the implant is more in intertrochanteric fracture with lateral cortex defect which leads to fracture collapse and implant.

Incase reverse oblique type of unstable fracture there is marked tendency for displacement of distal fragment by the pull of adductors. The fracture and displacement of lesser trochanter will lead to varus collapse of proximal fragment. Fixation with dynamic hip screw here will leads to excessive impaction, collapse and screw pull out.

OSTEOPOROSIS AND FRACTURE FIXATION.

Osteoporosis of bone plays a great part in the fracture fixation of Intertrochanteric fractures. Ward et all found that thicker trabecullae which is arising from calcar pass upwards towards the weight bearing zone of femoral head. Thinner trabecullae starts from inferior to fovea and pass along superior portion of femoral neck to trochanteric and lateral cortex.

Laros and Moore analyzed using Singh index found that implant failure rate is high if osteoporosis of bone by Singh index grade 3 or below .They suggested posteromedial placement of screw to decrease screw cut out.

CLASSIFICATION.

The classification used most commonly in pertrochanteric fracture is Evans classification which is based on stability of fractures.

EVANS CLASSIFICATION [1949]

Evans divided pertrochanteric fractures into stable and unstable groups. Unstable groups are further divided into those in which anatomical or near anatomical reduction of fracture restores stability and those in which stability cannot be restored even after anatomical reduction.

Type1. Fracture line starts at lesser trochanter and run upwards and outwards.

Type2. This is reverse obliquity fracture -Here fracture line starts at lesser trochanter and extends outward and downward .This is unstable group with medial displacement of femoral shaft because of adductor muscle pull.

Fig .11 Evans classification of pertrochanteric fractures

BOYD AND GRIFFIN CLASSIFICATION

This classification includes fractures that start from extracapsular part of neck and extends up to 5 cm distal to lesser trochanter .

Type 1. Undisplaced fracture along intertrochanteric line from the greater trochanter to lesser trochanter. Anatomical reduction and maintaining the reduction is simple here. Generally gives satisfactory results.

Type 2. This is comminuted fracture with main fracture along intertrochanteric line with multiple fractures in the cortex. There will be additional fracture in coronal plane in this type. Reduction of this type is more difficult.

Type 3. This is reverse oblique [subtrochanteric fracture] with associated varying degrees of comminution. These fractures are more difficult to reduce.

Type 4. These include fracture of trochanteric region and the proximal shaft, with fracture in two planes, one in sagittal plane which is difficult to recognize

Routine anteroposterior projection.

Fig 12 .Boyd and Griffin classification

OTA CLASSIFICATION

Intertrochanteric fractures are typed as 31A in orthopedic trauma Association classification.

Group 1. It is simple two part fractures.

Group2. Posteromedial comminution with intact lateral cortex at greater trochanter .

Group3. Here fracture line extends along both medial and lateral cortex. This group includes the reverse obliquity pattern.

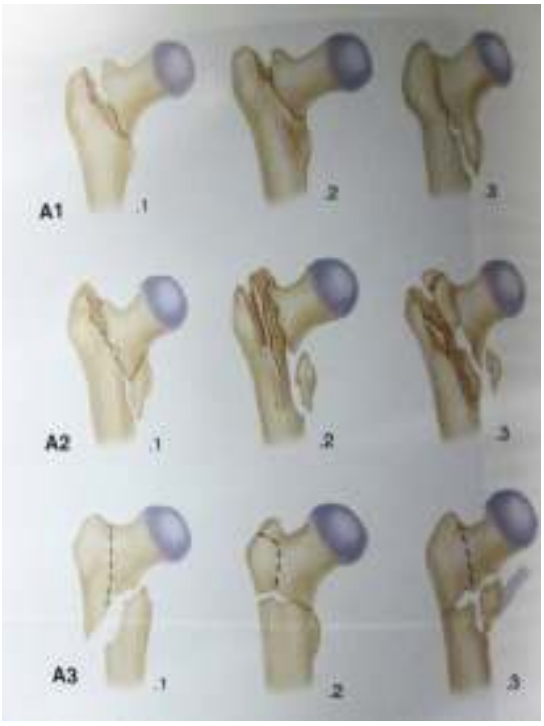


Fig 13 .OTA classification of pertrochanteric fracture

UNUSUAL FRACTURE PATTERNS.

In this the basicervical neck fractures that are located just proximal to intertrochanteric region. Basicervical fractures are more prone for osteonecrosis and also rotation of femoral head during implant Insertion as it lack cancellous interdigitations .

HISTORICAL REVIEW

1564 - It was **Ambrose Pare** who described fractures of proximal femur.

1882 – Sir Jacob Astley Cooper distinguishes intracapsular and extracapsular fractures. All fractures were treated conservatively at that period with bed rest.

19 th century– in the middle of this century traction and bed rest was tried with the aim of reducing shortening and deformity. Varus malunion of fracture and shortening of limb were the complications due to inadequacy of traction to overcome deforming muscular forces.

Operative management of intertrochanteric fractures was started around 1960 with aim of fracture reduction stabilization and early patient mobilization.Non operative treatment is of two approaches.

1. Here early mobilization of patient from bed to chair is done with the acceptance of deformity. In the second method skeletal traction is applied

with aim of establishing and maintaining a reasonable reduction. This approach is associated with lot of complications due to prolonged bed rest.

OPERATIVE MANAGEMENT.

The first implants were the fixed angle nail plate like Jewett nail and Holt nail. The disadvantage of this fixed angle nail plate was that it did not Provide controlled fracture impaction .So during significant impaction of fracture during weight bearing the implant would either penetrate into the hip joint or superior cut out of plate occur .Separation of plate from the femoral shaft would occur if there is no significant impaction .These complications gives rise to the development of sliding devices.

Sliding –nail plate device:

Massie nail, Ken –Pugh nail has nail that provide proximal fragment fixation and a side plate to allow telescoping of nail through it ,which improve bone to bone contact and fracture healing and decrease the stresses on implant thereby lowering risk of implant failure.

Sliding hip screw devices.

Here the nail portion of implant was replaced by screw with large outside thread diameter .Better proximal fragment fixation and less screw cut out was noted in this devices.

DYNAMIC HIP SCREW.

Introduced by **Clawson** in 1964 .Correct placement of implant is must to prevent complications .The screw should be placed in the centre of femoral head to avoid cut out .Avoid superior and anterior placement of screw which will lead to implant failure .**Baumgartner et all**[25] suggested the TAD tip apex distance ,which is the sum of the distance between tip of screw and apex of femoral head in both anteroposterior and lateral projection should be less than 25 mm to avoid screw cut out .For proper impaction of fracture and to avoid implant failure the barrel of screw should not cross the fracture site .

DHS has been used for stabilization of intertrochanteric fracture but its result in unstable fracture was not up to the mark .More number of implant failure and fracture reduction failure were noted .This leads to the development of intramedullary devices.

Bi-directional sliding.

Here telescoping of lag screw with impaction of fracture and axial sliding of plate along the femoral shaft occurs. **[Egger 's plate]**

Intramedullary devices:

Intramedullary nails were developed, with theoretical advantage of lesser bending movements than plate and screw devices as they are in the mechanical axis of femur [26, 27].

Gamma nail

Russel –Taylor nail

Ante grade trochanteric nail

Trochanteric fixation nail

Proximal femoral nail

These nails have the disadvantage of fracture femur below the tip of nail**.** In order to prevent the femoral shaft fracture the nail is modified by tapering the distal diameter the Proximal Femoral Nail.

LITERATURE REVIEW

1. K.S Leng et all in 1992 after treating 80 cases of intertrochanteric fractures with DHS and PFN noted that was minimal surgical trauma in those cases treated with intramedullary nail and also there was guided impaction of fracture in those intertrochanteric fracture treated with intramedullary nail .they concluded that intramedullary nail gives good results both stable and unstable fracture with complication rate of around 3 to 15% .

2. **Pajarinen et al in 2005** compared DHS and PFN in pertrochanteric fracture and reported that patients treated with PFN regain their preoperative mobility earlier than those treated With DHS. They also noted that there was statistically significant shortening of femoral neck in those patients treated with DHS which alters the hip biomechanics.

3. JBJS 1998 80:618.30 says that the operative time needed to Insert intramedullary nail was greater than that needed to insert DHS .It is also noted that the pain in mid thigh more likely when two distal locking screw was done.

4. Klinger H.M ET AL IN 2005 a three year study in Germany compared DHS and PFN in 173 patients reported that PFN has advantage of shorter operating

time, early weight bearing, shorter hospital stay with decreased complication rate in unstable fracture.

5. Banan .H. et al in 2002 UKafter treating 60 trochanteric fractures with PFN reported that the use of PFN in unstable intertrochanteric fracture is satisfactory but he suggested a large trial comparing DHS and PFN in in treating to clarify relative risks and benefits.

MATERIAL AND METHODS

The present study was carried out in Government Royapettah Hospital, Kilpauk Medical College from May 2012 to December 2013 .The study consist of total 20 adult patients of pertrochanteric factures of femur satisfying the inclusion criteria ,who are treated with Proximal Femoral nail (10 cases) and Dynamic Hip Screw(10 cases). It was a PROSPECTIVE STUDY. All the cases in the study were having intertrochanteric or subtrochanteric fractures. Patients from age group over 55 years and above were selected. The fractures were treated with closed method of reduction followed by either operated by Proximal Femoral Nail(PFN) or Dynamic Hip Screw(DHS). In all the patients with personal data, mode of trauma, type of fracture, type of surgery, intra operative &post operative complications, follow up examination including hip joint examination, duration of full weight bearing were considered.

INCLUSION CRETERIA

1. All patients age over 55 years with Pertrochanteric fractures
2. Both stable and unstable pertrochanteric fractures as classified by Evan
3. Intertrochanteric fractures and intertrochanteric with subtrochanteric Extension.

Exclusion criteria

1. Patients with pure subtrochanteric fractures
2. Patients with pathological fracture
3. Patients with multiple injuries

CHOICE OF NAIL USED

Proximal femoral nail of standard length that is 25 mm was used in our study.The nail was made up of AISI 316 L Stainless steel. The proximal diameter of nail is 14 mm which is upto proximal 8 cm of nail, while nail diameter of 9 mm to 12 mm was used in our study. All nails used were of 135 *.

There proximal portion of nail has two slots for accompanying the lag screw and the antirotation screw .The diameter of lag screw was 8 mm with length ranging from 55 to 115 mm was used. Antirotation screw of diameter 6.5 mm was used in our study, with length ranging from 55 to 115 mm. The distal portion of nail has two parallel slots for distal interlocking screws.

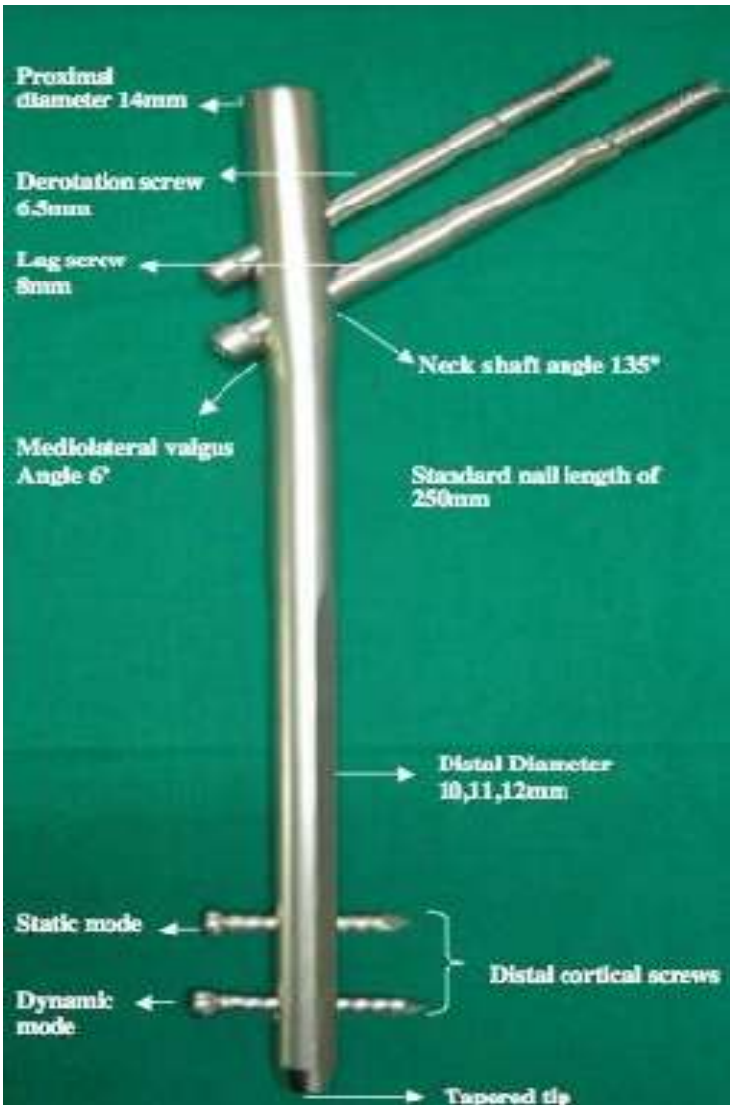


Fig13. Proximal femoral nail.

RICHARDS DYNAMIC COMPRESSION SCREW:

A cannulated lag screw with threaded distal portion of 12.7 mm diameter and the diameter of proximal unthreaded portion (shaft) is 8.7 mm . It came in various lengths from 50-110 mm. It was cannulated to accept a 3.2 mm guide wire.

The lag screw was inserted into the barrel of side plate into which it can slide. The groove in the shank of the lag screw, which corresponds to the key in the barrel, prevents the rotation. The side plate accommodates 4.5 mm cortical bone screws. Mostly 4 or 5 holed plate was used.

Fig 14. Dyanamic hip screw .

DATA COLLECTION.

A proforma was prepared and all the details of patient was entered in That proforma after admission .Patient discharged after completion of treatment and called for follow up at regular interval of 2 weeks, 1 month, 2 month and every month until fracture unites. At each visit the implant position, change in fracture alignment, fracture union and functional recovery was noted and entered in the proforma.

MANAGEMENT OF PATIENTS

All intertrochanteric and subtrochanteric fractures admitted in trauma ward were evaluated for eligibility criteria .Those found eligible were included in study and had been evaluated with necessary radiological and clinical investigations after necessary resuscitation and splintage using skin traction.

Patients were evaluated for associated medical problem and opinions were obtained from respective departments and necessary treatment given. Associated injury if any was evaluated and treated .After getting Assessment all patients were operated electively.

PRE OPERATIVE PLANNING.

DETERMINATION OF NAIL DIAMETER: It was measured at the level of Isthmus of femur in lateral X ray.

DETERMINATION OF NECK SHAFT ANGLE: It was measured using goniometer on the normal side .LENGTH OF NAIL: A standard nail length of 25 mm was used in our study.

OPERATIVE TECHNIQUE

Proximal femoral nail – under spinal anaesthesia patient in supine position under fracture table control fracture reduction by longitudinal traction followed by abduction and internal rotation .The unaffected leg is placed in flexed and abducted position for accommodating C-arm. The reduced fracture is provisionally fixed by passing k wire in the anterior cortex parallel to neck .This prevent opening out of fracture during adduction of limb.

5 cm long incision is made from tip of trochanter distally, guide wire inserted through tip of greater trochanter and passed through fracture site after checking its position in anteroposterior and lateral projection.Successive reaming done over the guide wire and nail inserted.

Proximal locking done using jig .The guide wire for the neck screw is to be inserted first which is usually parallel to the inferior border of neck. The guide wire for antirotation screw is inserted and the 6.4 mm antirotation screw inserted after tapping .The neck screw is inserted after tapping which is 10 to 15 mm longer than antirotation screw .Distal locking done using jig and wound closed in layers .

POST OPERATIVE PROTOCOL

Post operatively patient‘s blood pressure,pulse rate ,respiration and temperature were monitored .Foot end is kept elevated. Intravenous antibiotics were given for five days followed by oral antibiotics till suture removal. Suture removed on 12^{th} day .Blood transfusion if required was given. Patient was made to sit in the bed after 24 hours .Quadriceps set of exercises and knee mobilization exercises were immediately ,and were asked to weight bear using walker support depending on the pain tolerability of patient .Partial weight bearing allowed from fourth week and full weight bearing after clinical and radiological signs of union were noted.

DISCHARGE

Patient was discharged from the hospital once partial weight bearing is achieved with walker support.

FOLLOW UP.

After discharge patient was asked to come for follow up at 2 weeks, 1month, 2 month, and till fracture union occurs .Modified hip score was used for evalution.

Operative technique [DHS]

Patient in supine position under fracture table control, unaffected hip Placed in abduction and flexed position .Fracture reduction done by longitudinal traction followed by abduction to correct varus and external rotation and then internal rotation of distal segment.

After draping skin incision is made from distal end greater trochanter upto 8 cm distally and fascia splitting done, splitting of vastus lateralis done which expose the trochanter and proximal part of femur.

The 135 * angle guide placed at 2 cm from the vastus ridge, Guide Wire was inserted into the femoral head and its position checked in anteroposterior and lateral X ray .The wire should be in the center or posterior in both projections. The length of pin inside the femoral head was measured using direct

measuring device .Then triple reaming was done 10 mm less than the length measured. Tapping was done until positive stop rest at the lateral cortex.

Lag screw was then inserted and the T handle kept perpendicular to the femoral shaft at the end .The DHS plate was inserted and impacted into the lag screw using impactor. The DHS plate is fixed to the bone using 4.5 mm cortical screws. Wound closed in layers.

Post - operative care:

1. Operated limb was elevated for a day.

2. Intravenous broad spectrum antibiotics were given for 5 days and then shifted to oral antibiotics.

3. IV fluids were given till patient started orally.

4. Suction drain was removed after 48 hours.

5. Static quadriceps exercises were begun on 2nd post - operative day.

6. Active quadriceps exercises and hip flexion exercises were then started on 4th or 5th post operative day.

7. Patient was ambulated non-weight bearing with axillary crutches.

8. Sutures were removed on 12th (alternate) and complete suture removal done on 14th post -operative day.

9. Partial weight bearing was started after clinically and radiologically evaluated at about 6 weeks post operatively.

10. Full weight bearing allowed only after the confirmation of radiological and clinical union.

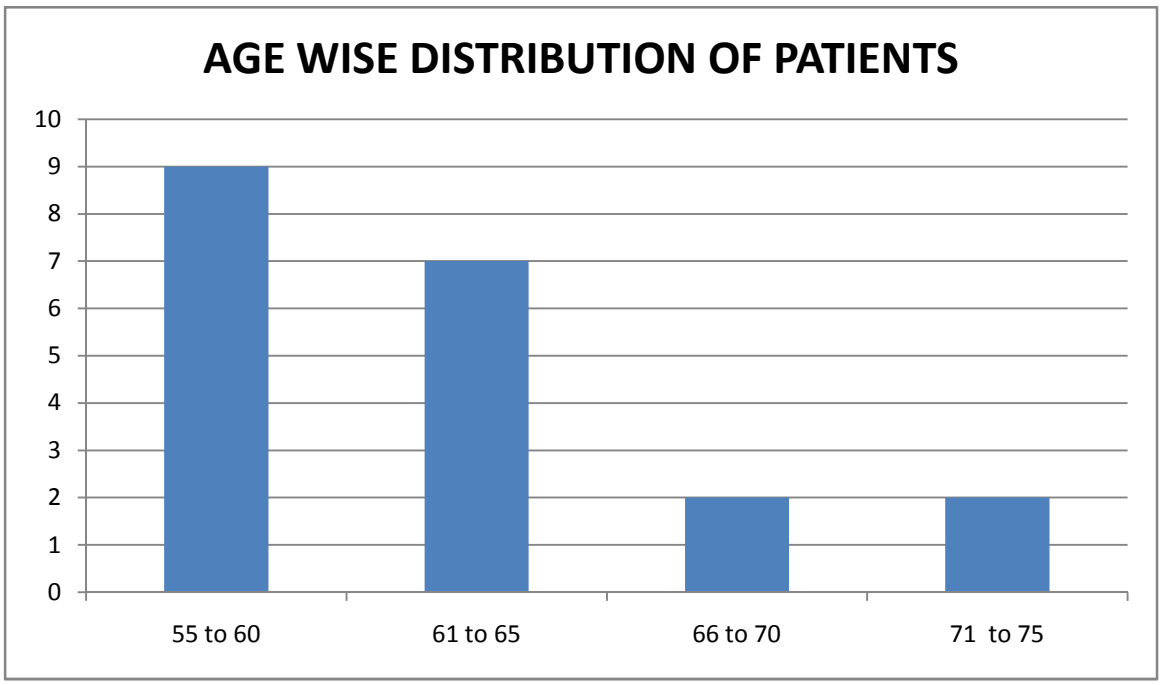
OBSERVATIONS AND RESULTS

The following observations were made from the data collected during this comparative study of proximal femoral nail and dynamic hip screw in the treatment of 20 cases of Pertrochanteric fractures of proximal femur in the Department of Orthopaedics, Government Royapettah Hospital Kilpauk Medical College from May 2012 to December 2013 .

TABLE 1

AGE WISE DISTRIBUTION OF PATIENTS

Age group	N0 of patients in DHS group	Patients in PFN group	Total
55 to 60	4	5	9
61 to 65	3	4	7
66 to 70	2	0	2
71 to 75	1	1	2
Total	10	10	20



1. In our study majority of cases were in the age group of 55 to 65 years 16 cases [80%]

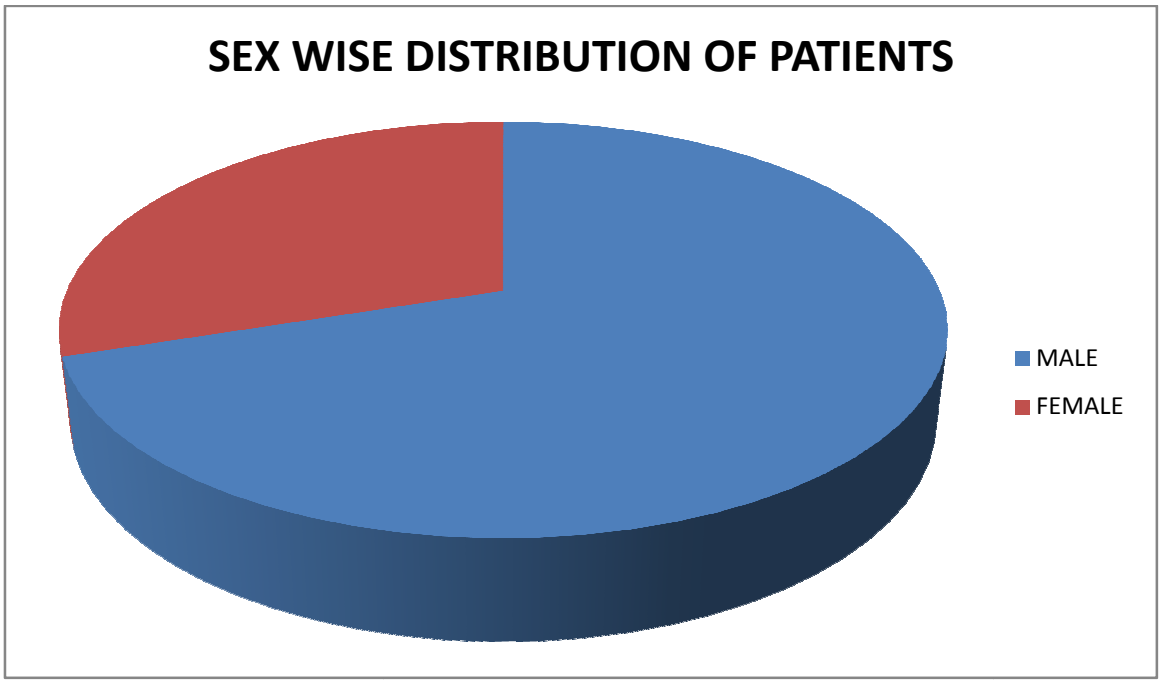
2. Mean age of patient in DHS group = 63.2 years

3. Mean age of patient in PFN group = 61.1 years

TABLE 2

SEX WISE DISTRIBUTION OF CASES

Sex	DHS	PFN
Male	6	8
Female	4	2
Total	10	10

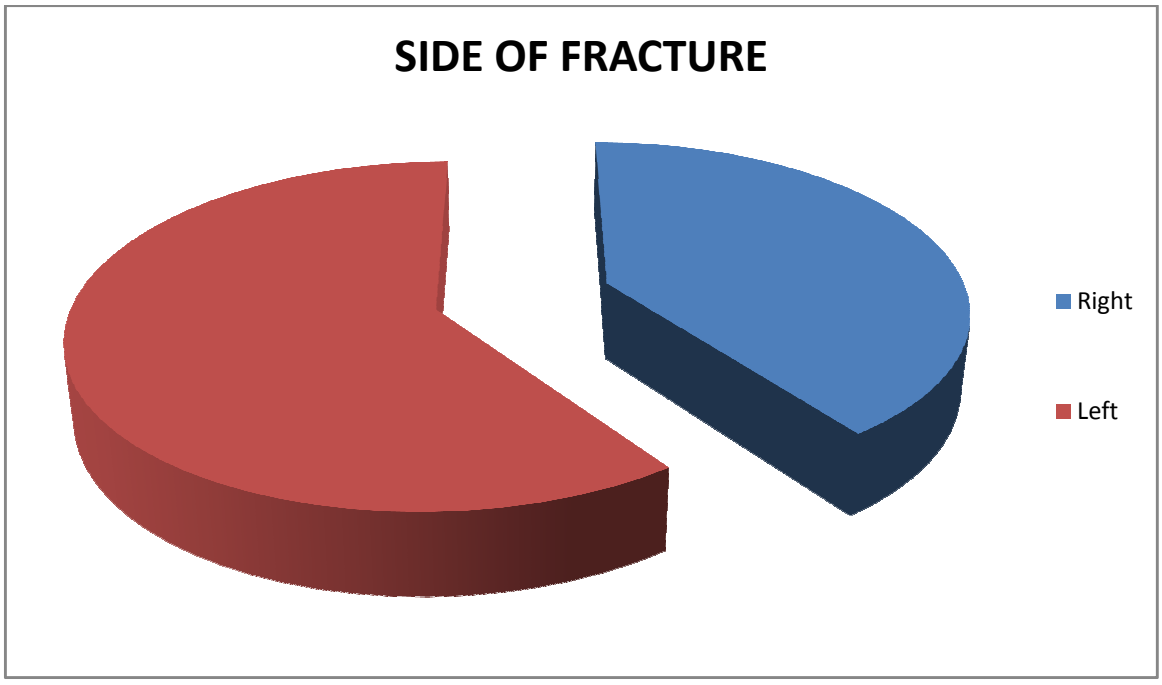


Males predominates in our study [70 %]

TABLE 3

DETAILS OF FRACTURE PATTERN [EVANS CLASSIFICATION] OF PATIENTS TREATED FOR PERITROCHANTRIC FRACTURES OF FEMUR

Side	DHS	PFN	Total
Right	3	5	8
Left	7	5	12
TOTAL	10	10	20



Most of cases in our study were left sided 12 cases [60 %]

TABLE 4

OPERATIVE DETAILS OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE OF FEMUR

OPERATIVE DETAILS	Dynamic Hip Screw	Proximal Femoral Nail
Mean time of operation after fracture in days	7.2	5.8
Mean duration of operation in minutes	69.9	52.1
Stable fracture	60.8	44.3
Unstable fracture	82.5	55.4
Mean blood loss in ml	163	97.5
Stable fracture	152.3	101.6
Unstable fracture	180	95.7
Mean length of incision in cm	9.1	5.6
Stable	9	5.57
Unstable	9.25	5.61

1. The mean duration of operation is more in DHS group then the in PFN group and in the DHS group its more in unstable fractures

2. The mean blood loss is more in unstable fractures of DHS group \

3. Mean length of incision is more DHS group comparing the PFN group .

TABLE 5

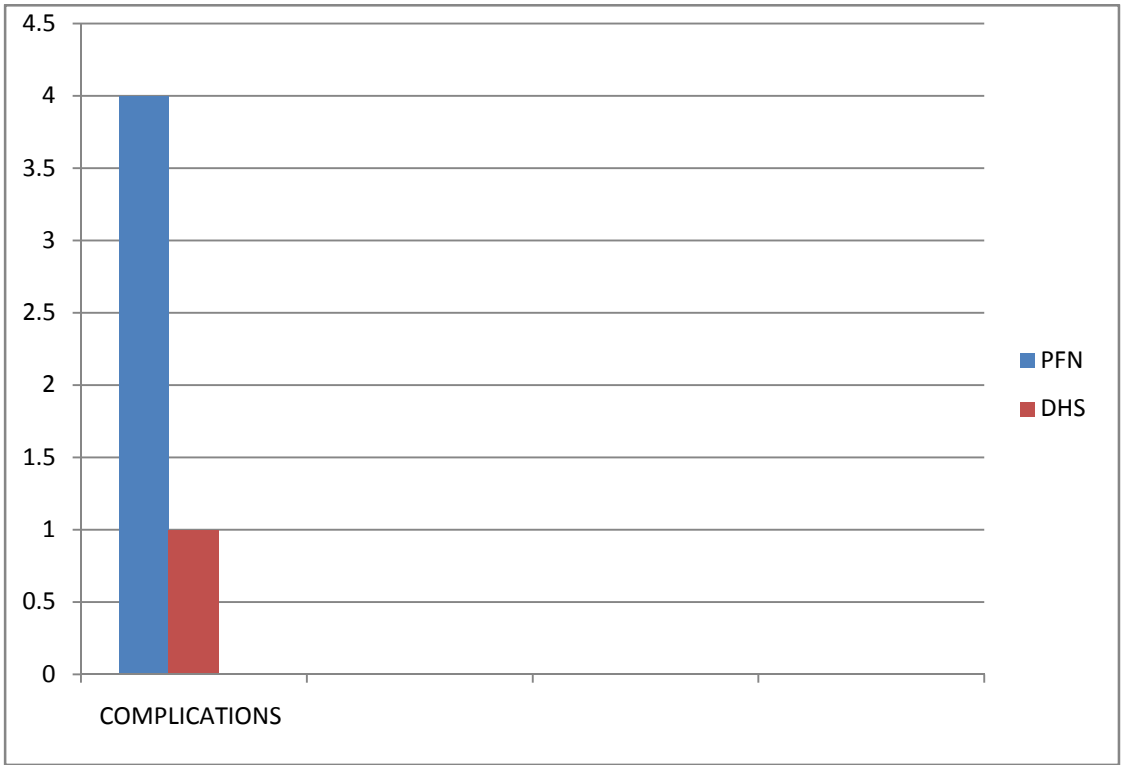
IMPLANT DETAILS OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE OF FEMUR

Details of implant	**Dynamic Hip Screw**	**Proximal Femoral Nail**
Mean length of lag screw in mm	84.5	86
Mean Nail diameter in mm	-	9.8

TABLE 7

INTRAOPERATIVE COMPLICATIONS OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE

COMPLICATIONS	DYNAMIC HIP SCREW	PROXIMAL FEMORAL NAIL
Failure of reduction Stable fractures Unstable fractures	1 1	1 1
Fracture of lateral cortex Stable fractures Unstable fractures	0	0
Jamming of nail Stable fractures Unstable fractures	-	0
Difficulty in introducing two screws in neck Stable Unstable	-	1 1
Failure of distal locking Stable fractures Unstable fractures	-	 1
Drill bit breakage Stable fractures Unstable fractures		 1



Intraoperative complications are more in PFN group [4 cases] then DHS group [1 case]

TABLE 7

RADIOLOGICAL OUTCOME OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE OF FEMUR

Radiological Outcome	**Dynamic Hip Screw**	**Proximal Femoral Nail**
Fracture reduction Stable fractures Good Fair Unstable Fractures Good Fair	 5 1 3 1	 3 6 1
Position of lag screw Stable fractures Good Fair Unstable fractures Good Fair	 5 1 3 1	 3 5 2
Mean Tip apex distance in mm	16	17.2

Fracture reduction was good in stable fractures in DHS group and unstable fractures in PFN group.

TABLE 8

POST OPERATIVEOUTCOME OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE OF FEMUR

Outcome	**Dynamic hip screw**	**Proximal femoral nail**
Mean duration of hospital stay in days	6.8	6.2
Time of weight bearing in weak [mean] Stable Unstable	9.5 7.3 12.5	3.6 3.6 3.7
Pain in Hip Stable Unstable	 2 2	 2 2
Pain in Thigh Stable Unstable	0	2 1 1

1. Mean duration of hospital stay is more in DHS group.

2. Time of weight bearing is late in unstable type of DHS group.

3. Time of weight bearing is earlier in PFN group than DHS and are nearly equal for both stable and unstable type.

4. Pain in hip occurs in 2 cases in both DHS and PFN group.

5. Pain in thigh occurs in 2 cases of PFN group, but there is no case of pain in thigh in DHS group.

TABLE 9

POST OPERATIVE COMPLICATIONS OF PATIENTS TREATED FOR PERTROCHANTRIC FRACTURE OF FEMUR

COMPLICATIONS	**Dynamic Hip Screw**	**Proximal Femoral Nail**
Infection	1	0
Lag screw cutting out	1	1
Fracture femoral shaft	0	0
Shortening > 2 cm	1	0
Varus displacement >10 *	1	0

1. One case of infection in DHS group

2. One case of lag screw cutout in DHS group and one case of 'Z' effect in PFN group

3. Shortening of more than 2 cm in one case and varus displacement in one case in DHS group ,both are seen in unstable type .for whom implant exit and heel rise was adviced.

4. There is no infection, distal femoral shaft fracture, shortening and varus displacement in PFN Group. Post operative Complications is less in PFN group comparing to DHS group.

TABLE 10

POSTOPERATIVE DETAILS RADIOLOGICAL OUTCOME OF PATIENTS TREATED FOR PERTROCHANTRIC FRACTURE OF FEMUR

Outcome	**Dynamic hip screw**	**Proximal femoral nail**
Fracture healing		
Stable Fractures		
Healed	10	10
Healed with < 10* varus displacement	0	0
Unstable fractures		
Healed	10	10
Healed with < 10* varus displacement	1	0
Mean duration of fracture union in wks	19.9	15.2
Stable fractures	18.6	14.6
Unstable fractures	22.5	15

1. Union occurred in all fractures in our study but there is one case of shortening and varus malunion in unstable type DHS group.

2. Mean duration of fracture union is earlier in PFN group, [15.2weeks] comparing to DHS group [19.9 weeks].

3.The duration fracture union is more in unstable type comparing to stable type in DHS group but it ‘s nearly same in both type in PFN group.

TABLE 11

CLINICAL OUTCOME OF PATIENTS TREATED FOR PERTROCHANTERIC FRACTURE OF FEMUR

Functional score	**Dynamic hip screw**	**Proximal femoral nail**
Mean Harris hip score in 6 weeks	69.34	81.23
Mean Harris Hip Score in 20 weeks	80.2	83.57

1. Mean HARRIS hip score is more in PFN group at 6 weeks after surgery. But it becomes nearly equal in both groups at 20 weeks period.

2. PFN group had early rehabilitation and weight bearing.

PFN Case 1

Preoperative **Immediate post operative**

6 weeks post op **4 month post op** **1 year post op**

Case 2

Pre operative

Immediate post operative

2 weeks postoperative

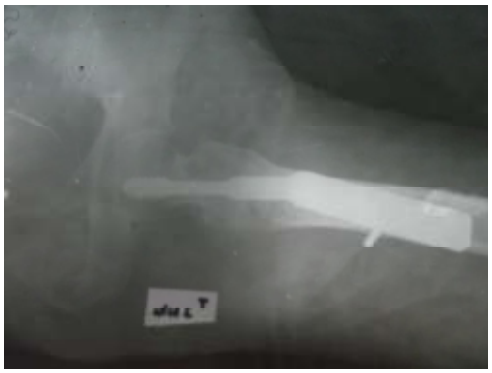
6 WEEKS POST OPERATIVE

6 MONTH POST OPRATIVE

6 months follow up

DHS case 1

Preoperative **Immediate post operative** **2 weeks post operative**



2 weeks postoperative **1 ½ month post operative**

Functional outcome

Case 2

Preoperative **Immediate post operative** **1 month postoperative**

2. month postoperative **6 month postoperative**

Functional outcome at 6 months

DISSCUSSION

Intertrochanteric fracture is a challenge to orthopedic community besides achieving union the need here is the restoration of optimal Function in shortest period with minimal complications. So the aim in treating intertrochanteric fracture has drifted to achieve

1. Stable fixation

2. Early mobilization and rehabilitation

3. Making the patient functionally and psychologically independent by returning them to premorbid home and work environment. Operative treatment of pertrochanteric fracture aid in achieving all the above aim and is the treatment of choice now.

Our study is an attempt to study, evaluate, document and quantify our in the management of pertrochanteric fractures by using DHS and PFN.

The study was conducted with 20 patients [10 by DHS and 10 by PFNwith pertrochanteric fractures attending casualty and OP department of orthopaedics Government Royapettah Hospital from May 2012 to Dec 2013 .

1. **Age distribution**.

Most of our patients were in the age group of 5th to 7th decade. The mean age in years of patients in our study was 62.15.mean age in years for group operated by PFN is 61.1. The mean age in years for group operated by DHS is 63.2. This may be because of decrease in protective reflex in elderly patients, and so frequent fall while walking. Gallaghar et al in 1980 reported that the risk of intertrochanteric fracture increases by 8 times in men over 80 years and women over 50 years.

Age reported by other author is as follows

Name of author	Age in years
Cleaveland and Thompson 1947	76.0
Marray and Frew 1949	62.5
Boyd and Griffin 1949	69.7
Scott 1951	73.3
Wade and Cambpell 1959	72.0
Sarmiento 1963	71.9
Gupta 1974	51.2

Increased rate of intertrochanteric fracture in elderly population are due to

1. Region being most common site of senile osteoporosis and is weak in elderly patients.
2. Hip is the major weight bearing joint .the weakened part of bone In elderly patients is not able to withstand sudden abnormal stress. To prevent fractures in elderly population the risk factors such as poor lighting , slippery floor , wet slippers should be avoided.

2.SEX DISTRIBUTION .

In our study males predominate females. Majority females who sustain fractures are between 5 to 7 th decade of life. The ratio of male female was 2;1 in both groups .

David G. Lovelle reported more incidences of trochanteric fractures in female than males.

Melton J.L Riggs et all 1982 in their study fifty years trend in hip fractures incidence reported female predominance.

Cleveland et al explains the reason for more incidence in females

1. Females have wide pelvis with tendency to have coxavara

2. Less active and more prone to osteoporosis the reason for more incidences in males in our study is more active life style of male and more acceptance of surgery by males in our area. The reported incidence is operated incidence and not the incidence of fracture.

3.Mode of injury .

The mode of injury in elderly is due to domestic fall while in young its due to road traffic accidents .In PFN group 6 case [60 %] were due to domestic fall and 4 cases [40%] were due to road traffic accidents .In DHS group 7 cases [70%] were due to domestic fall and 3 cases were due to road traffic accident [30%].

Cummings and Nevett 1994 reported the cause for domestic fall and fracture in elderly as

1. Inadequate protective reflexes.

2. Inadequate shock absorber around thigh ,muscle , fat .

3. Inadequate bone strength at hip due to osteoporosis .

Horn and wangs states that it is the sudden bending and shearing stress that leads to fracture than the direct injury. In case of direct injury to thigh contusion of soft tissue and comminution of lateral cortex of greater trochanter were noted.

4. Type of fracture.

We had nine cases of Evans stable of which DHS was in 6 cases and PFN in 3 cases .11 cases of Evans unstable fracture of which DHS was done in 9 cases and PFN in 3 cases.

5. Side of fracture.

We have studied 20 cases of different types of intertrochanteric in our present study. Amongst the 10 fractures cases operated by PFN, 5(50%) patients were found to have proximal femoral fractures on the left side while 5(50%) patients were having fracture on the right side. Amongst the 10 cases operated by DHS, 7(70%) patients were found to have proximal femoral fractures on the left side while 3 (30%) patients were having fracture on the right side.

6. Time duration between hospital admission and surgery

Most of cases were operated within 10 days of admission .In 4 out of 20 patients operative procedure was delayed due to associated

medical illness. Average time lapse for surgery is 7.25 days. Out of 4 patients two were reported late to the hospital.Evans states that there is 30% of mortality in conservative immobilization.Active surgical approach can decrease mortality.

7. Associated Injures

In present study series we have found 2 patients with associated injuries amongst 10 patients operated by PFN, out of which 1 patient was having fractures of distal end radius and one patient had ipsilateral fracture calcaneum . One patient with fracture distal end radius on contralateral side were treated in same operative setting by closed manipulation reduction and followed by cast application (As patients were given general anesthesia & to minimize the risk of conservative method was chosen.While one patient with ipsilateral fracture calcaneum was treated conservatively.

We have not found patients with head injury, blunt abdominal, blunt chest injury, Also there were no patients with ipsilateral fracture shaft femur in the patients treated by PFN.

8.Average length of nail used & Average size of barrel plate :

In our present study we have used of uniform length i.e. 25mm long nail. As in present study we have intertrochanteric fractures of type I, II and III IV of

Evans classification. So, need for using long length proximal femoral nail was eliminated .we used 135*, 4 holed barrel plate in the cases treated by DHS.

9. Diameter of the Nail

In present study series nails of diameter 9mm to 12mm were available. In two cases we have used nail of diameter 9mm, In 8 cases nail of 10 mm diameter while . No patient was found to have medullary diameter of 12mm so PFN of that diameter was not used. In Indian population average diameter of medullary canal is found to between 9-10 mm. Proximal femoral nail has two segments i.e. proximal and distal. Proximal segment is of 8 cm and is of uniform diameter i.e. 14mm irrespective of diameter of distal fragment.

10. Length of screws

In our study we used screws of length 75 to 115 mm.in one case we used 70 mm screw, 75 mm screw in one case, 85 mm screw in 5 cases ,90 mm screw in two cases and 95 mm screw in one case. Antirotation screw of length 65 to 90 were used.65 mm screw in one case 70 mm screw in two cases, 75 mm in four cases, 80 mm in three cases .

11. Complications

Systemic complications:

In patients treated with PFN as well as DHS, one patient in each group was found to have chest infection while in other patient we found complication of urinary tract infection. The patients with chest infection were known case of COPD, as they were chronic bidi smoker. Appropriate treatment was given before surgery Prolonged catheterization was noted as cause for urinary traction infection treated with appropriate antibiotics.

12. Wound Complications

Superficial would infection was noted in one patient operated by DHS. It was superficial infection and may be attributed to the glycemic status of patient as he was a known diabetic .There was also more soft tissue exposure in DHS group.In all these patients treated with prolonged intravenous antibiotics.

13. Implant related intraoperative complications.

In two cases of PFN operated cases we encountered ill fitting jig .Due to this the corresponding holes in jig did not match with holes in proximal part of nail and proximal screw nail was a problem. Besides this we had one case of difficulty in fracture reduction and one case of failure in distal locking.

In the DHS group we had difficulty in reduction in one case which is due to delay in surgery as it was a known case of diabetic and operated late.

14. Rotational malalignment.

External rotational deformity of 15 * was noted in one case of PFN group. Varus deformity was noted in one case in DHS group which was due to excessive backout and screw cutout.

Shortening of 0 .8 to 1 cm was noted in 2 unstable cases in DHS group but they had no walking abnormality.

15. Radiological complications.

In PFN group we encountered one case of ‘Z’ effect and there was no case of reverse ‘Z’ effect.

X ray showing Z effect in PFN

In DHS group we had one case screw cut out.

Screw cut out in DHS

16. Other complications

Radiation exposure was more in PFN group than in DHS group.

Blood loss measured by mop count [each fully soaked mop counting 50ml] is more in DHS group which is because of wide exposure.

17. Range of movement.

Range of movement using Harris hip score was in favor PFN group after six weeks of operation. But at the end of twenty weeks it became nearly equal.

SUMMARY

With increase in automobile the road traffic accidents are increasing day by day. The life expectancy of Indian population is 64 now due to advances in modern medicine and awareness in health care. The increase in life expectancy and road traffic accidents results in increase in volume of intertrochanteric fracture .The osteoporotic bone in elderly people are more prone for fracture .Before surgical treatment invention all intertrochanteric fractures were treated with traction and prolonged immobilization which had disadvantages of bed sores ,urinary tract infection ,pneumonia ,thrombosis .surgical treatment was then started with aim of stable

Fixation early mobilization and to make the patient functionally and psychologically independent. Of so many implants in the treatment of intertrochanteric fracture DHS was most frequently used device .PFN was introduced in 1996 by AO ASIF for fixation of unstable intertrochanteric fracture.

The features of this nail are

1. Additional 6.5 mm antirotation screw
2. Greater implant length.

3. The diameter of tip is smaller than proximal and is fluted to avoid stress raising effect below tip

4. More proximal insertion of distal locking screws which is to prevent abrupt change in stiffness of implant construct

Our study was conducted at Government Royapettah Hospital from May 2012 to Dec 2013 20 patients were included in our study with 10 in DHS group and 10 in PFN group .Each case was followed up for atleast 6 months and in each visit clinical radiological and functional outcome was noted .These details were analyzed evaluated and compared .The observations are summarized as follows

1. **Age:** most of the patients in our study were between 55 to 65 years. Mean age in years in PFN group was 61.1 and in DHS group was 63.2 and the mean age in years in combined both groups was 62.15.

2. Sex: There was a male preponderance in our patients. A male to 2female ratio was about 2:1. There were 6 male cases and 4 female cases operated by PFN, while there were 8 male cases and 2 female cases operated by DHS.

3. Mode of Injury: Most common mode of injury in young patients is the road traffic accident while most common mode of injury in older patients is the simple fall (Domestic fall).

4. **Type of fractures:** In the study, we have 9 (45%) intertrochanteric fractures with Evans stable, 11(55%) cases were of Evans unstable fractures.Out of 9 Evans stable intertrochanteric fractures DHS was done in 6 cases and PFN in 3 cases. While 11 of Evans unstable intertrochanteric fractures DHS done in 4 cases and PFN in 7 cases.

5. Side of the fracture: Amongst the 10 cases operated by PFN, 5(50%) patients were found to have proximal femoral fractures on the left side while 5(50%) patients were having fracture on the right side. Amongst the 10 cases operated by DHS, 7(70%) patients were found to have proximal femoral fractures on the left side while 3 (30%) patients were having fracture on the right side.

6. Majority of patients in present study series were operated within 10days following admission in hospital (16/20). But in some patients (4/20) operative procedure was delayed because of delay in presentation.

7. In associated injuries, 1 patient had associated injuries Amongst10 patients operated by PFN. In DHS group one patient with fracture distal end radius on contralateral side were treated in same operative setting by closed manipulation reduction and followed by cast application .There were no patients with head injury, blunt abdominal, blunt chest injury. There were no patients with ipsilateral fracture shaft femur in the patients treated by PFN.

8. Average length of Nail used and average size of Barrel plate: The PFN nail used were of uniform length of 25mm. The average barrel plate used in DHS was 135° 4 holed plates.

9. Diameter of the nail in PFN was from 9mm to 12mm. In two cases we have used nail of diameter 9mm, In 8 cases nail of 10 mm diameter were used.

10. Length of proximal screws used: In PFN, the lag screw in range of 75mm to 115mm. Amongst them, in 1 case(10%) we have used 70mm screw, in 1 cases (10%) we have used 75 mm screw, in 5 cases(50%) we have used 85mm screw, 2 cases(20%) 90mm screw and in 1 cases(10%) we have used 95mm screw.

11. Anti rotation screw or hip pin screw was used in range of 65-80 mm dimensions. In 1 case (10%) we used screw of 65mm, in 2cases (20%) 70mm, in 4 cases (40%) 75mm and in 3cases(30%) 80mm screws were used.

12. Systemic complications: In both the groups' i.e PFN as well as DHS, one patient in each group was found to have chest infection while in other patient we found complication of urinary tract infection (UTI). The patients with chest infection were known case of COPD, as they were chronic bidi smoker.

13. Wound complications .one case superficial wound infection in our study which may be due diabetic status of patient and prolonged surgery in unstable DHS.

14. Implant related intraoperative complications: In 2 cases (20%) operated cases by Proximal Femoral Nailing (PFN), there was ill fitting of jig. Due to the corresponding holes of jig and nail was not matching at times the position of the proximal screws was a problem. Failure of distal locking in one case and failure of reduction in one in PFN group were noted

While in those cases operated by Dynamic Hip Screw (DHS) we encountered 1 case (10%) having difficulty in reduction.

15. Rotational malalignment: External rotation of 15° was noticed in one case(10%) operated by Proximal femoral Nail(PFN). Varus deformity was noted in one case(10%) in DHS group and shortening of 0.8 to 1 cm was found in two cases .

16. Radiological complications : In present study, the cases that we operated by Proximal Femoral Nail (PFN) we have encountered 'z' effect in one case.screw cut out was noted in one case of dhs group **.**

17. Period of Hospitalization: Average time of admission in hospital was 21 days i.e. 3 Weeks.

18. Mobilization: We found the mobilization of patients operated by both PFN and DHS in our study was almost same but the weight bearing of patients in the PFN group was earlier.

19. Average time of Fracture Union: Average time of union in all our 20 patients was about 16 weeks (Range: 12 to 20 weeks).

20. Intra operative radiation exposure and Mean blood loss: There is comparatively less blood loss in patients managed by proximal femoral nail as compared to patients of Dynamic Hip Screw group. The mean blood loss in PFN group was 120 milliliters of blood while as compared to the mean blood loss in DHS group it was 180 milliliters.

21. The average time of screening by image intensifier was lesser in cases operated by DHS as compared to those operated by PFN. The less exposure in DHS is because of wide exposure .In PFN group radiation is more during proximal screw insertion.

22. **Range of movement by Harris Hip score** was in favor of PFN group at 6 weeks postoperatively but it becomes equal at 20 weeks

CONCLUSION

This study carried out in Government Royapettah Hospital from May 2012 to Dec 2013 include 20 pertrochanteric fractures .Out of which 10 were operated by Dynamic Hip screw and 10 were operated by Proximal femoral nail.

1. The advantage of PFN was smaller incision, less blood loss, less morbidity.
2. Shorter lever arm and lower bending moment in PFN may add mechanical advantage to the construct.
3. PFN found to be the implant of choice in osteoporotic bones.
4. Malrotation and deformity in treating pertrochanteric fracture found to be less in our study.
5. Mean blood loss was less in PFN group.
6. Varus collapse and shortening in unstable was more in DHS group than PFN group.
7. There was no femoral shaft fracture in our study though it was reported as complication in literature.
8. The learning curve of DHS was smaller comparing PFN.
9. Radiation exposure was less in DHS group than PFN group

10. Implant related complications during surgery were less in DHS group than PFN group.
11. Rate of fracture union was similar in both groups with early immobilization in PFN group.
12. DHS found to be the implant of choice as for as stable fracture is concerned .But for unstable fracture the pendulum swings in favor of PFN.

BIBLIOGRAPHY

1. AngSen JO. Intertrochanteric osteotomy for failed internal fixation of femoral neck fracture.ClinOrthop. 1997; 341:175-182

2. Ansari Moein CM, Verhofstad. MHJ, Bleys RLAW, Werken C van der (2005) Soft tissue injury related to the choice of entry point in ante grade femoral nailing; pyriform fossa or greater trochanter tip. Injury 36:1337-1342

3. Albareda J, Laderiga A, Palanca D *et al* Complications and technical problems with the gamma nail. *IntOrthopl996; 20*: 47-50.

4. Al-Yassari G, Langstaff RJ, Jones JW, Al-Lami M. The AO/ASIF.proximal femoral nail (PFN) for the treatment of unstable trochanteric femoral fracture.*Injury* 2002; 33 -395-399.

5. Anne AK, Ekeland A, Odegaard B *et al.* Gamma nail versus compression screw for trochanteric femoral fracture. *ActaOrthopScand*1994 ; 65 : 127-130

6. A comparative study of unstable per- and intertrochanteric femoral fractures treated with dynamic hip screw (DHS) and trochanteric butt- press plate vs. proximal femoral nail (PFN) ZentralblChir - Aug 2005 - IC linger HM, Baums HM, Eckert M.

7. BabhulkarSudhir S. Management of trochanteric Fractures Department of - Orthopaedics, Indira Gandhi Medical College, Nagpur, *INDIAN JOURNAL OF ORTHOPAEDICS October 2006* volume 40: Number 4: P. 210-218.

8. Ballmer FT, Ballmer PM et al. Pauwels osteotomy for nonunions of the femoral neck. Orthopaedic Clinics of North America. Oct. 1990; 21,4: 759-767

9. Banan H, Al-Sabti A, Jimulia T, Hart AJ.The treatment of unstable, extracapsular hip fractures with the AO/ASIF proximal femoral nail (PFN)—our first 60 cases. Injury 2002;33:401-5.

10. Bartonicek J, Dousa P, Skala-Rosenbaum J, Kost'dl R. Trochanterickezlomeniny. Soubornyreferat Trochanteric fractures. A current concepts review], Urazovachirurgie 2,001; 10.

11. Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extrameduilary fixation for the treatment of intertrochanteric hip fractures.ClinOrthopRelat Res 1998;348:87-94.

12. Berman AT, Metzger PC, Bosacco SJ et al. Treatment of the subtrochanteric fractures with the compression hip nail: a review of 38 consecutive cases. Orthop Trans. 1979; 3:255.

13. Bergman GD, Winkist RA, Mayo KA, Hanson SE. Subtrochanteric fractures of the femur: fixation using the Zickel nail. J Bone Joint Surg (Am). 1987; 69A: 1032-1040

14. Biomechanical evaluation of the proximal femoral nail. Schipper IB, Bresina S, Wahl D, Linke B, Van Vugt AB, Schneider E. University Hospital Rotterdam Dijkzigt, Dept. of Traumatology, Rotterdam, Netherlands, ClinOrthopRelat Res. 2002 Dec;(405):277-86.

15. Blatter G, Janssen M. Treatment of subtrochanteric fractures of the femur: reduction on the traction table and fixation with dynamic condylar screw. Arch Orthop Trauma Surg 1994; 113:138-41.

16. Brumback RJ, Uwagie-Ero S, Lakatos RP, Poka A, BathonGH,Burgess AR. Intramedullary nailing of femoral shaft fractures. Part II: Fracture-healing with static interlocking fixation. J Bone Joint Surg (Am). 1988;70:1453-62.

17. Broos PL, Reynders P. The use of the unreamed AO femoral Intramedullary nail with spiral blade in non pathologic fractures of the femur: experiences with eighty consecutive cases. J Orthop Trauma 2002; 16:150-4.

18. Boidin C, Seibert F, Fankhauser F et al. The proximal femoral nail (PFN)-A minimal invasive treatment of unstable proximal femoral fractures.A prospective study of 55 patients with a follow-up of 15 months.ActaOrthopScand 2003; 74: 53-58.

19. Boriani S, Bettelli G, Zmerly H, Specchia L, Bungaro P, Montanari G, et al. Results of the multicentric Italian experience on the Gamma nail: a report on 648 cases. Orthopedics 1991; 14:1307-14.

20. Baumgaertner MR, Curtin SL, Lindskog DM, Keggi JM. The value of Tip-Apex distance, in predicting failure of fixation of peritrochantericfractures of the hip.J Bone Joint Surg (Am). 1995;77:1058-1064

21. Boyd HB, Griffin LL. Classification and treatment of trochanteric fractures. Arch Surg. 1949; 58:853

22. Butt MS, Krikler SJ, Nafie S, Ali MS. Comparison of dynamic hip screw and gamma nail: a prospective randomized controlled trail. Injury 1995;26:615-8.

23. Borens O, Wettstein M, Kombot C, Chevalley F, Mouhsine E, Garofalo R. Long gamma nail in the treatment of subtrotrochantericfractures.ArchOrthop Trauma Surg 2004;124:443-7

24. Brien WW, Wiss DA, Becker V Jr, Lehman T. Subtrochanteric femur fractures: a comparison of the Zickel nail, 9.5-degree blade plate, and interlocking nail. J Orthop Trauma 1991; 5:458-64.

25. Browner BX, Cole JD. Current status of locked intramedullary nailing:a review. J Orthop Trauma. 1987;1(2):183-95.

26. Barquet A, Mayora G, Fregeiro J, Lopez L, Riemzi D. Francescoli L. The treatment of subtrochantericnonunions with the long gamma nail: twenty-six patients with a minimum 2-year follow-up. J Orthop Trauma 2004;18:346-53.

27. Behr JT, Dobozi WR, Badrinath K. The treatment of pathologic and impending pathologic fractures of the proximal femur in the elderly.ClinOrthop Related Res 1985;198:173-8.

28. Proximal femoral nail for unstable peritrochanteric fractures a panacea? byDr Sanjay Bhandari. Journal of MaharashtaOrthopaedic Association vol 2 year 1 DEC 2005

29. Cech O et al. Stabilmosteosynteza v traumatologii a orthopedii [Stable osteosynthesis in 'traumatology and orthopaedics].,Praha: Avicenum, 1982

30. Complex proximal femoral fractures in the elderly managed by reconstruction nailing - complications & outcomes: a retrospective analysis UlfmRethnam, James Cordell-Smith, Thirumoolanathan M Kumar and AmitSinha Department of Orthopaedics, GlanClwyd

Hospital, Bodelwyddan, UK ,2 Department of Orthopaedics, Morriston hospital, Swansea, UK, 3 11 Fordd Pare Castell, Bodelwyddan, Rhyl, LL18 5WD, UK Journal of Trauma Management & Outcomes 2007, l:7 doi:10.1186/l752-2897-1-7

31. Curtis MJ, Jinnah RH, Wilson V, Cunningham BW. Proximal femoral fractures: a biomechanical study to compare intramedullary or extramedullary fixation. Injury 1994 ; 25 : 99-104

32. Daniel FA, Noesberger B. Is the Proximal Femoral Nail a suitable implant for Treatment of all Trochanteric Fractures? ClinOrthopaed Related Res 2005: 439: 221-7. 3.

33. Davis TR, Sher JL, Horsman A, Simpson M, Porter BB, Cliecketts RG. Intertrochanteric femoral fractures.Mechanical failure after internal fixation.J Bone Joint Surg (Br). 1990;72(l):26-31.

34. A Dhal, M Varghese, VB Bhasin. External fixation of intertrochanteric fractures of the femur. J Bone Joint Surg (Br), 199.1; 73: 955 - 958 ' •

35. Dean GL, David S,- Jason HN (2004) Osteoporotic pertrochateric fractures; management and concurrent controversies. J Bone JtSurg (Am) 72-B:737-752 .

36. Desjardins AL, Roy A, Paiement G, et al. Unstable intertrochanteric fractures of the femur: A prospective randomized study comparing anatomical reduction and medial displacement osteotomy. J Bone Joint Surg (Br). 1993; 75:445-447

37. Doherty JH Jr, Lydee JP. Intertrochanteric fractures of the hip treated with the hip compression screw: analysis of problems. ClinOrthop.1979; 141:184-7.

38. Domingo LJ, Cecilia D, Herrera. A, Resines C (2001) Trochanteric fractures treated with a proximal femoral nail. IntOrthop 25:298-301 [PubMed]

39. Dousa P, Bartonicek J, Jehlicka D, Skala-Rosenbaum J (2002) Osteosynthesis of trochanteric fracture using proximal femoral nail. ActaChirOrthopTraumatolCech 69:22-30 [PubMed]

40. DeLee JC, Clanton TO, Rockwood CA Jr. Closed treatment of trochanteric fractures of the femur in a modified cast-brace. J Bone Joint Surg Am 1981;63:773-9.

41. Dora C, Leunig M, Beck M, Rothenfhih D, Ganz R. Entry point soft tissue damage in antegrade femoral nailing: a cadaver study. J Orthop Trauma 2001;15:488-93.

42. Domingo LJ, Cecilia D, Herrera A, Resines C. Trochanteric fractures treated with a proximal femoral nail. IntOrthop2001 ;25:298-301.

43. BoppeSt SH. The sliding compression screw:—Today's best answer for stabilization of intertrochanteric hip fractures. OrthopClin North Am. 1980 Jul; 11 (3):507-23.

44. Doskocil J. Nasezkusenosti s lecboupertrochanterickyehzlomeninpripouziti DHS [Our experiences with the treatment of pertrochanteric fractures with the use of DHS].Urazovachirurgie 2002; 10.8.

http://www.synthes.com/html/PFNA_Proximal_Femora. 5417.0.

45. Ecker ML, Joyce JJ III, Kohl EJ. The treatment of trochanteric hip fractures using a compression screw. J Bone Joint Surg (Am). 1975 Jan;57(l):23-7.

46. Egol KA, Kubiak EN, Fulkerson E, Kummer FJ, Koval KJ. Biomechanics of locked plates and screws. J Orthop Trauma 2004;18:488-93.

47. Fielding JW, Magliato HJ. Subtrochanteric fractures; SurgGynecol . Obstet. 1966; 122:555

48. Friedl W, Colombo-Benkmann M, Dockter S, Machens HG, Mieck U. Gamma nail osteosynthesis of per- and subtrochanteric femoral fractures. 4 years experiences and their consequences for further implant development [in German]. Chirurgie 1994;65:953-63.

49. Frigg R, Appenzeller A, Christensen R, Frenk A, Gilbert S, Schavan R The development of the distal femur less invasive stabilization system (LISS). Injury 2001 ;32Suppl3:SC24-S'C31..

50. Flah'iff CM, Nelson CL, Gruenwald JM, Mollis JM. A biomechanical evaluation of an intramedullary fixation device for intertrochanteric fractures. J Trauma 1993 ; 35 : 23- 27.

51. Fogagnolo F, Kfuri M Jr, Paccola C. Intramedullary fixation of pertrochanteric hip fractures with the short AO/ASIF proximal femoral nail. Arch Orthop Trauma Surg2004 ; 124 :. 31-37.

52. Gainor BJ, Buchert P. Fracture healing in metastatic bone disease. ClinOrthopRelat Res 1983;178:297-302 Gulberg B, Duppe H, Nilsson B (1993) Incidence of Hip Fractures in Malmo, Sweden (1950-1991). Bone 14[Suppl l]:23-29

53. Haidiskewycli GJ, Israel TA, Berry BJ. Reverse obliquity fractures of the intertrochanteric region of the femur. J Bone Joint Surg (Am). 2001; 83:643-650

54. Haider SC. The gamma nail for peritrochanteric fractures. J Bone Joint Surg1992 ; 74-B : 340-344.

55. Heinz T, Vescei V. Complications and errors in use of the gamma nail. Causes and prevention.Chirurgie1994 ; 65 : 943-952.

56. Herrera A, Domingo LJ, Calvo A et al A comparative study of trochanteric fractures treated with the Gamma nail or the proximal.IntOrthop 2002;26 : 365.

57. Herlin K, Stromberg T, Petersson H, Walioe A, Lidgren L. Trochanteric fractures—-a clinical and radiologic evaluation of McLaughlin,Ender, and Richard's osteosynthesis. Arch Orthop Trauma Surg.l9S9-10S(l):36-9

58. Holz TK, Zellweger R, Kach KP. Minimal invasive treatment of proximal femur fractures with the long gamma nail: indication, technique, results. J Trauma 1999;47:942-5.

59. Haidukewych GJ, Berry DJ. Non-union of.fractures of the subtrochanteric region of the femur. ClinOrthop Related Res 2004;419:185-8.

60. Haidukewych GJ, Jacofsky DJ, Hanssen AD, Lewallen DG. Intraoperative fractures of the acetabulum during primary total hip arthroplasty. J Bone Joint Surg 2006; 88: 1952-1956

61. Haidukewych GJ, Berry DJ. Hip Arthroplasty for salvage of failed treatment of intertrochanteric hip fractures. J Bone Joint Surg (Am). 2003; 85:899-904

62. Haynes RC, Poll RG, Miles AW, Weston RB. Failure of femoral head fixation: a cadaveric analysis of lag screw cut-out with the gamma locking nail and AO dynamic hip screw. Injury 1997;28:337-41.

63. Hesse B, Gachter A. Complications following the treatment of trochanteric fractures with the gamma nail. Arch Orthop Trauma Surg 2004;124:692-8.

64. Is the Proximal Femoral Nail a suitable implant for treatment of all trochanteric fractures?,Menezes, Daniel F. A MD; Gamulin, Axel MD; Noesberger, Bruno MD, Clinical Orthopaedics and Related Research: October 2005 - Volume 439 - Issue - pp 221-227

65. Intramedullary Fixation of Subtrochanteric Fractures with long Proximal Femoral Nail or long Gamma Nail: .Technical Notes and Preliminary Results Lei-Sheng Jiang, IMA PhD, Lei Shen,lMD, Li-Yang Dai,MD, PhD

66. Jensen JS, Sonne-Holm S, Tondevold E. Unstable trochanteric fractures.A comparative analysis of four methods of internal fixation. ActaOrthop Scand. 1980 Dec;51(6):949-62.

67. Jensen JS, Tondevold E, Sonne-Holm S. Stable trochanteric fractures. A comparative analysis of four methods of internal fixation.ActaOrthop Scand. 1980 Oct;51 (5):811-6.

68. Kaufcr H. Mechanics of the treatment of hip injuries. ClinOrthop Related Res 1980;146:53-61.

69. Kaufer H, Matthews LS, Sonstegard B. Stable fixation of intertrochanteric fractures. J Bone Joint Surg (Am). 1974;56(5):899- 907.

70. Kempf I, Grosse A, Beck G. Closed locked intramedullary nailing. Its application to comminuted fractures of the femur.J Bone Joint Surg (Am). 1985; 67(5);709-20.

71. Klemm KW, Borner M. Interlocking nailing of complex fractures of the femur and tibia. ClinOrthop.1986; 212:89-100.

72. Kannus P, Oarlclari J, Sievanen H et al (1996) Epidemiology of hip fractures. Bone 18[Supl]:57—63.

73. Kim WY, Han CH, Park JI, Kim FJY (2001) Failure of intertrochanteric fracture fixation with a dynamic hip screw in relation to preoperative fracture stability and osteoporosis. IntOrthop 25:360- 362.

74. Kinast C, Bolliofeer BR, Mast JW, Ganz R. Subtrochanteric fractures of the femur: results of treatment with 95 degrees condylar blade plate. ClinOrthop.1989; 238:122.

75. Kempf I, Grosse A, Beck G. Closed locked intramedullary nailing. Its application to.comminuted fractures of the femur. J Bone Joint Surg (Am). 1985; 67(5):709-20.

76. Klemm KW, Borner M. Interlocking nailing of complex fractures of the femur and tibia.' ClinOrthop. 1986; 212:89-100

77. Koch JC. The laws of bone architecture.Am J Anat. 1917; 21:177.

78. Koval KJ, Aliaroeoff GB, Rokito AS, Lyon T, Zuckermann JD. Patients with femoral neck and intertrochanteric fractures: Are they the same? Clin Orthop.1996; 330:166-172

79. Koval&Zukermann intertrochanteric fractures hand book of fractures 81

80. Krettek C, Muller M, Miclau T. Evolution of minimally invasive plate osteosynthesis (MIPO) in the femur. Injury 2001; 32Suppl3: SC 1:4- SC23

81. Kyle RF, Ellis TJ, Templeman DC. Surgical Treatment of Intertrochanteric Hip fractures with associated femoral neck fractures using a sliding hip screw. J Orthop Trauma. Jan 2005; 19,1:1-4

82. Kuner E, Schlosser V. Traumatologic [Traumatology], Stuttgart: Thieme 1995

83. Larssoii S, Elloy M, Hansson LI. Fixation of unstable trochanteric hip fractures. A cadaver study comparing three different devices.ActaOrthop Scand. 1988; 59(6):658-63.

84. Landon GC, Mehlhoff T, Tullos HS. Total Hip Arthroplasty following failed internal fixation of hip fractures.ClinOrthop.1991; 269:32-37.

85. Laskin RS, Gruber MA, Zimmerman A J. Intertrochanteric fractures of the hip in the elderly: a retrospective analysis of 236 cases. ClinOrthop. 1979 Jun;(141): 188-95.

86. Leung KS5 So WS, Sien WY, Hui PW. Gamma nail and dynamic! hip screws for peritrochanteric fractures. J Bone Joint Surg (Br). 1992;

87. Long proximal femoral nails versus sliding hip screw-plate device for the treatment of intertrochanteric hip fractures - A randomized prospective study in 100 elderly patients Milind M. Porecha M.S. Ortho Assistant professor Orthopedics department M.P.Shah Medical

College Guru Govind Singh Hospital Deepak S. Parmar M.S. Ortho Associate professor Orthopedics department M.P.Shah Medical College Guru Govind Singh Hospital The Internet Journal of Orthopedic Surgery™ ISSN: 1531-2968

88. Lunsjo K, Ceder L, Thomgren KG, Skytting B, Tidermark J, Burntson ; PO. Extramedullary fixation of 569 unstable intertrochanteric fractures.ActaOrthop Sea no 2001; 72:133-40.

89. Lustenberger A, Ganz R. Epidemiology of trochanteric femoral fractures over 2 decades (1972-1988) [in German], Unfallchirurgie 1995;98:278-82

90. Madsen JE, Naess L, Aune AK, Alho A, Ekeland A, Stromsoe K. Dynamic hip screw with trochanteric stabilizing plate in the treatment of unstable proximal femoral fractures: A comparative study with the Gamma nail and compression hip screw. J Orthop Trauma.1998; 12:241-248.

91. Manoli A 2nd. Malassembly of the sliding screw-plate device.J Trauma. 1986; 6(10):916-22.

92. Marti RK, Schuller HM, Raaymakers ELFB.Intertrochanteric osteotomy for nonunion of the femoral neck.J Bone Joint Surg (Br). 1989; 71-B:782~7.

93. Masek M, Mach P, Reska M. Strategieosetrovanizlomeninhoraihokoncestehennikosti [Strategy of treatment of fractures of the upper end of femur] ,http://www.chirurgie.cz

94. Miedel R, Ponzer S, Tornkvist H, Soderqvist A, TidermarkJ.The standard Gamma nail or the Medoff sliding plate for unstable

trochanteric and subtrochanteric fractures: A randomised, controlled trial. J Bone Joint Surg Brit 2005; 87: 68-75.

95. Minimal invasive treatment of proximal femur fractures with the long Gamma Nail: Indication, Technique, Results Holz, Thomas K. MB; Zellweger, Rene MD; Kadi, Kurt P. MB , The Journal of Trauma: Injury, Infection, and Critical Care: November 1999 - Volume 47 - Issue 5 - p 942

96. Mattsson P, Alberts A, Dahlberg G, Sohlman M, Hyldahl HC and Larsson S. Resorbable cement for the augmentation of internally fixed unstable trochanteric fractures'. A prospective, randomized multicentre study.J Bone Joint Surg Brit 2005; 87: 1203-9.

97. A mechanical comparison of subtrochanteric femur fracture fixation ; PUGHK. J.(1) ; MORGAN R. A. (1) ; GORCZYCAJ. T. (1); PIENKJOWSKI D. (1) Journal of orthopaedic trauma ISSN 0890- 5339 Source / Source 1998, vol. 12, n°5, pp. 324-329 (31 ref.)

98. Menezes DF, Gamulin A, Noesberger B (2005) Is the proximal femoral nail a suitable implant for treatment of all trochanteric fractures? ClinOrthop Related Res 439:221-227 [PubMed

99. Medoff RJ, Maes K. A new device for the fixation of unstable peritrochanteric fractures of the hip. J Bone Joint Surg (Am). 1991;73:1192-1199

100. Miedel R, Ponzer S, Tornkvist H, Soderqvist A, Tidermark J. The standard Gamma nail or the Medoff sliding plate for unstable trochanteric and subtrochanteric fractures: A randomised, controlled trial. J Bone Joint Surg Brit.

Name	Age sex	s/ us	R /L	D / P	PR OP M	DOS M	BL ml	In L In cm	LS L in mm	ND in mm	IOP C	FR	LSP	TAD	T WB in wks	pom	Ph	PT	I	LSC	S > 2 c m	V> 10*	HHFS In 20wk	FU IN W
Thangappan	58/m	1	2	1	1	70	200	9	85	-	5	1	1	18	8	1	2	2	2	2	2	2	83	16
Saroja	70/f	1	2	1	1	62	150	8	70	-	5	1	1	14	7	1	2	2	2	2	2	2	82	18
Harikrishnan	62/m	1	1	1	1	68	160	11	85	-	5	1	1	19	8	1	1	2	2	2	2	2	86	18
Susila	57/f	1	2	1	1	45	120	10	75	-	5	1	1	13	6	1	2	2	1	2	2	2	84	17
Sabarirajan	56/m	1	2	1	1	60	150	8	90	-	5	1	1	15	7	1	2	2	2	2	2	2	86	20
Balasundhar	64/m	2	1	1	1	85	250	9	85	-	5	1	1	12	12	1	2	2	2	2	2	2	73	26
Palani	58/m	1	2	1	1	60	130	8	95		5	1	1	12	8	1	1	2	2	2	2	2	84	20
patchiappan	70/m	2	1	1	1	90	200	10	85	-	4	2	2	19	9	1	2	2	2	1	1	1	72	24
mariyaarokkiyam	72/f	2	2	1	2	75	150	8	90		5	1	1	20	14	1	2	2	2	2	2	2	75	18
Rajammal	65/f	2	2	1	1	80	120	10	85		5	1	1	18	16	1	2	2	2	2	2	2	81	22
Abbas	58/m	1	2	2	1	45	120	5	90	10	5	1	1	15	5	1	2	1	2	2	2	2	89	16
Marimuthu	62/m	2	2	2	1	40	100	5	85	10	3	1	1	13	6	1	2	2	2	2	2	2	75	16
Shankar	56/m	2	1	2	1	50	80	5	85	10	5	2	1	15	3	1	2	2	2	2	2	2	69	14
Magesh	62/m	1	2	2	1	40	85	6	90	10	2	1	1	17	2	1	2	2	2	2	2	2	84	16
Brindhavanam	56/m	2	2	2	1	54	100	8	95	9	4	2	2	22	3	1	2	2	2	2	2	2	89	14
sarojaammal	75/f	2	2	2	1	65	90	5	85	10	5	1	1	18	4	1	2	2	2	2	2	2	84	15
Selvam	58/m	1	1	2	1	48	100	6	95	10	5	1	1	18	2	1	2	2	2	2	2	2	88	12
Jothi	64/m	2	1	2	1	64	90	5	90	10	5	1	1	21	2	1	1	2	2	2	2	2	84	16
Nataraj	57/m	2	1	2	1	55	90	5	95	10	5	1	1	19	2	1	1	1	2	2	2	2	81	14
Annal	63/f	2	1	2	1	60	120	6	80	9	5	1	1	17	3	1	2	2	2	1	2	2	89	16

INDEX FOR MASTER CHART

S/US –

1-Evans stable/

2-unstable fracture

R/L –

1-Right

2-Left

D/P –

1-DHS

2-PFN

PR OP M-Pre operative mobility

1.Independent

2 .Aided

3. withsupport

Bl ml-Blood loss in ml

DOSM-Duration of surgery in

Minutes

IN L in cm-incision length in cm

LSL in cm-Lag screw length in cm

ND in mm-Nail Diameter in mm

IOPC

–Intraoperative complications

1-Fracture of lateral cortex

2-failure of distal locking

3-failure of insertion of two screws

in neck

4-failure of reduction

5-no complications

PT-pain thigh

1-Present

2- Absent

PH –Pain hip

1-Present

2- Absent

I-Infection

1-Present

2-Absent

LSC –Lag Screw Cutting out

1-present

2-Absent

HHFS-Harris hip function score in 20 week's

FR -Fracture reduction

1-Good

2-fair

LSP –Lag screw position

1-Good

2-Fair

TAD –Tip Apex Distance in mm

TWB in weeks –Total weight bearing in weeks

LSC-Lag Screw cutting out

1-Present

2-absent

S >2 cm –Shortening more than 2 cm

1-present

2-absent

V> 10* -Varusmalunion more than 10*

1-present

2-absent

FU in W –Fracture union in weeks.

PROFORMA

NAME: DOA:

AGE: DOS:

SEX: DOD:

ADDRESS:

IP. No:

Occupation :

Diagnosis : Evan's stable /unstable intertrochantric fracture side

Mode of injury :

Associated injury :

Surgery done :

Blood loss : Duration of surgery:

1. **Operative details**

   Duration of operation

   Blood loss

   Length of incision

   Lag screw length in DHS

   Nail diameter IN PFN

2. Intraoperative complications

Failure of reduction

Fracture of lateral cortex

Jamming of nail

Difficulty in introducing two screws in neck

3. Radiological outcome

Immediate post operative

Fracture reduction

Position of lag screw

Tip apex distance

4. Post operative outcome

Duration of hospital stay

Time of full weight bearing

Post operative mobility

Pain in hip

Pain in thigh

5. Post operative complications

Infection

Lag screw cutting out

Fracture of femoral shaft

Varus displacement of > 10*

External rotation

Shortening > 2 cm

6. Clinical outcome

Postoperative walking ability

No aids needed

With aids

In need of assistance

7. Hip function score [Harris hip score]

6 weeks

20 weeks

Follow up X -rays at

At 2 weeks

At 6 weeks

At 10 weeks

At 14 weeks and 4 months and till fracture unites .

The fracture healing to be followed up and the changes in position of fracture and

Implant are to be recorded and considered as secondary measure of outcome .

HARRIS HIP SCORE

Pain	Support
☐ None, or ignores it	☐ None
☐ Slight, occasional, no compromise in activity	☐ Cane/Walking stick for long walks
☐ Mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin	☐ Cane/Walking stick most of the time
☐ Moderate pain, tolerable but makes concessions to pain. Some limitations of ordinary activity or work. May require occasional pain medication stronger than aspirin	☐ One crutch
☐ Marked pain, serious limitation of activities	☐ Two Canes/Walking sticks
☐ Totally disabled, crippled, pain in bed, bedridden	☐ Two crutches or not able to walk

Distance walked	Limp
☐ Unlimited	☐ None
☐ Six blocks (30 minutes)	☐ Slight
☐ Two or three blocks (10 - 15 minutes)	☐ Moderate
☐ Indoors only	☐ Severe or unable to walk
☐ Bed and chair only	

Activities - shoes, socks	Stairs
☐ With ease	☐ Normally without using a railing
☐ With difficulty	☐ Normally using a railing
☐ Unable to fit or tie	☐ In any manner
	☐ Unable to do stairs

Public transportation	Sitting
☐ Able to use transportation (bus)	☐ Comfortably, ordinary chair for one

	hour
☐ Unable to use public transportation (bus)	☐ On a high chair for 30 minutes
	☐ Unable to sit comfortably on any chair

To score this section all four must be 'yes', then get 4 points. Nb. Not 1 point for each four or nothing.

Section 2	
Does your patient have ALL of the following: -	
☐ yes ☐ no	Less than 30degrees of fixed flexion Less than 10 degrees of fixed int rotation in extension Less than 10 degrees of fixed adduction Limb length discrepancy less than 3.2 cm (1.5 inches)

Section 3 - Motion	
Total degrees of Flexion	**Total degrees of Abduction**
☐ None	☐ None
☐ 0 >8	☐ 0 > 5
☐ 8 > 16	☐ 5 > 10
☐ 16 > 24	☐ 10 > 15
☐ 24 > 32	☐ 15 > 20
☐ 32 > 40	**Total degrees of Ext Rotation**
☐ 40 > 45	☐ None
☐ 45 > 55	☐ 0 > 5
☐ 55 > 65	☐ 5 > 10
☐ 65 > 70	☐ 10 > 15
☐ 70 > 75	**Total degrees of Adduction**
☐ 75 > 80	☐ None
☐ 80 > 90	☐ 0 > 5
☐ 90 > 100	☐ 5 > 10

C 100 > 110	C 10 > 15

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Ref.No.3393/ME-1/Ethics/2013 Dt:02.05.2013
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Study of functional and radiological outome of petrochantric fracture in elderly patients treated with dynamic hip screw or proximal femoral nail" - For Project work submitted by Dr.B.Ramesh, MS (Ortho), PG Student, GRH, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

GOVT. KILPAUK MEDICAL COLLEGE
09 OCT 2013
Kilpauk, Chennai-10.

9/10/13

CHAIRMAN,
Ethical Committee
Govt.Kilpauk Medical College,
Chennai